INTERIM RECORD OF DECISION
September 2006

Site SS-01, Brandywine DRMO
Andrews Air Force Base, Maryland

United States Air Force

United States Environmental Protection Agency

Region III

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LIST OF ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	contaminant of concern
COMAR	Code of Maryland Regulations
COPC	contaminant of potential concern
CSF	cancer slope factor
CSM	conceptual site model
CTE	central tendency exposure
DCE	dichloroethene
DNAPL	dense non-aqueous phase liquid
DO	dissolved oxygen
DoD	Department of Defense
DRMO	Defense Reutilization and Marketing Office
EE/CA	Engineering Evaluation/Cost Assessment
EIAP	environmental impact analysis process
EPA	Environmental Protection Agency
ERA	ecological risk assessment
ERP	Environmental Restoration Program
FAA	Federal Aviation Administration
FFS	focused feasibility study
ft	foot
GAC	granulated activated carbon
gpm	gallons per minute
HAZWRAP	Hazardous Waste Remedial Action Program
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
HRC	Hydrocarbon Release Compound
IC	Institutional Control
IROD	Interim Record of Decision
kg	kilogram
LTM	long term monitoring
LUC	Land Use Controls
IRP	Installation Restoration
MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
MDL	Method Detection Limit
mg/L	milligrams per liter
MNA	Monitored Natural Attenuation
µg/L	microgram(s) per liter
mV	millivolts
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	operation and maintenance
OMB	Office of Management and Budget
ORP	oxidation/reduction potential

PBB	permeable biostimulation barrier
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PGCHD	Prince George's County Health Department
PGCDER	Prince George's County Department of Environmental Resources
PLFA	phospholipid fatty acid
RAB	Restoration Advisory Board
RACER	Remedial Action Cost Engineering and Requirements
RAO	remedial action objective
RBSL	risk-based screening level
RfD	reference dose
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SVOC	semivolatile organic compound
TBC	to-be-considered
TCE	trichloroethene
TOC	total organic carbon
UCL	upper confidence limit
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	volatile organic compound
WSSC	Washington Suburban Sanitary Commission

INTERIM RECORD OF DECISION

1.0 DECLARATION

1.1 SITE NAME AND LOCATION

Site SS-01, Brandywine DRMO
Brandywine, Prince George's County, Maryland
EPA Superfund Site ID No. MD9570024803

1.2 STATEMENT OF BASIS AND PURPOSE

This Interim Record of Decision (IROD) presents the selected interim remedial action for Site SS-01, the Brandywine Defense Reutilization and Marketing Office (DRMO) and its surroundings, including the soil and groundwater which have been impacted by release of hazardous substances from the DRMO (also referred to as "the Brandywine site" or "the site" throughout this document). The Brandywine site is located in Prince George's County, Maryland and administered by Andrews Air Force Base. The interim remedial action was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The Brandywine site was listed on the National Priorities List (NPL) by the United States Environmental Protection Agency (USEPA) on May 10, 1999 (64 Fed. Reg. 24949).

The information supporting the decisions on the selected interim remedial action contained in this IROD is based on information contained in the Administrative Record file for Brandywine. The United States Air Force (USAF) and USEPA have made the interim remedial action selection for the site addressed by this IROD. The Maryland Department of the Environment (MDE) concurs with the selected interim remedial action. A letter from MDE indicating its concurrence is provided in Appendix A.

1.3 ASSESSMENT OF THE SITE

The response action selected in this IROD is necessary to protect public health and the environment from actual and threatened releases of hazardous substances into the environment.

1.4 DESCRIPTION OF THE SELECTED INTERIM REMEDIAL ACTION

The DRMO yard, which occupies approximately eight acres, is bounded to the west by an active CSX railroad track and to the east and north by wooded areas. Residential areas are located east, southeast, south, southwest, and west of the DRMO yard.

The DRMO yard is predominantly open and covered with grass. Remnants of former buildings and paved areas are also present. The DRMO was used from 1943 to 1987 as a storage area for waste and excess government material generated by several U.S. Navy and USAF installations. Waste materials containing volatile organic compounds (VOCs) and polychlorinated biphenyls (PCBs) were stored at the site and have contributed to site contamination (Dames & Moore, 1992a).

Groundwater at Site SS-01 has been affected by releases of chemicals, most of which occurred before closure of the DRMO in 1980 (URS, 2001). The releases likely included mainly surface discharges of VOCs, primarily chlorinated solvents. Petroleum hydrocarbons mostly from a nearby property not associated with the DRMO and partially from DRMO were also found in the groundwater. This interim action is necessary to protect current and future residents from unacceptable risks associated with an uncontrolled plume at the site (see Section 2.7, Summary of Site Risks, for further detail).

Site investigations and the human health risk assessment (HHRA) indicated that contamination in groundwater poses an unacceptable risk to the health of future residents and commercial workers who may build homes or work over the areas containing high concentrations of contaminants. Current residences are located over dilute portions of the groundwater plume. Current residents, commercial workers, and other potential current receptors do not face unacceptable health risks from contaminated groundwater because the community is supplied by public drinking water. Because contaminated groundwater at the Brandywine site does not discharge to ground surface, contaminants in groundwater do not pose risks to ecological receptors.

Soil cleanup is addressed in the Engineering Evaluation/Cost Analysis, Site SS-01, Former Brandywine DRMO (URS 2006a). Results of the soil removal action will be summarized in the final Record of Decision (ROD) for the site. This IROD pertains to an initial remedial action to begin the cleanup of groundwater at the site.

The extent of groundwater contamination at the Brandywine site is discussed in depth in the Brandywine Remedial Investigation (RI) report (URS, 2005) and summarized here. Based on historical evidence and the groundwater and soil data presented and discussed in the Brandywine RI, the releases of CERCLA-regulated hazardous substances at the Brandywine DRMO resulted in three distinct plumes of dissolved chlorinated solvents in the groundwater. The area of highest contaminant concentrations occurs west and northwest of the DRMO yard. The release or releases responsible for generating this plume most likely occurred near the northwest corner of the DRMO yard. A smaller, disconnected plume is located within the DRMO yard. There also is a smaller plume located to the northeast of the DRMO yard. The spill or spills responsible for groundwater contamination within the DRMO yard were events separate from the spills responsible for groundwater contamination northwest of the yard; the plumes are spatially disconnected. The plume within the DRMO yard is smaller and has lower concentrations of contaminants as is the smaller plume to the northeast.

The most significant groundwater contaminants at the site, as defined by areal extent and concentrations above the maximum contaminant levels (MCLs) for federal drinking water standards, are trichloroethene (TCE), tetrachloroethene (PCE), and cis-1,2-dichloroethene (DCE). The maximum concentrations of TCE and PCE measured at the site are 224.2 milligrams per liter (mg/L) and 0.349 mg/L, respectively. The MCL for TCE and PCE is 0.005 mg/L. The maximum cis-1, 2-DCE concentration measured at the site was 13.4 mg/L. The MCL for cis-1, 2-DCE is 0.070 mg/L. The results of the site investigations indicate that the VOCs in groundwater at the Brandywine site are present both as dissolved contaminants and as droplets or pools of dense non-aqueous phase liquid (DNAPL) that contain primarily TCE.

A Focused Feasibility Study (FFS) was undertaken in 2005 to evaluate remedial action alternatives that would address contamination associated with groundwater at the Brandywine site (URS, 2006b). The FFS concluded that the Contaminants of Potential Concern (COPCs) in groundwater at the site are TCE, PCE, cis-1, 2-DCE, vinyl chloride, naphthalene, 2-methylnaphthalene, iron, and manganese. The TCE and PCE were likely released into the groundwater due to site activities.

Vinyl chloride and cis-1, 2-DCE are products of the biodegradation of TCE and PCE in the vicinity of the DRMO. Iron and manganese are naturally occurring metals that have been released from the aquifer due to biodegradation of the volatile organic contaminants in groundwater.

In conjunction with the FFS, two treatability studies were initiated in 2005 to determine if in-situ chemical oxidation or enhanced in-situ biodegradation could accelerate and enhance the naturally occurring degradation process to cleanup the groundwater. Results of the studies indicate that the VOCs can be treated in-situ with specific oxidants or with specific carbon substrates and the addition of microbes (bioaugmentation) to enhance biodegradation. A more detailed discussion of the treatability studies can be found in Section 2.2.2.4.

Due to the presence of DNAPL in the source area for the groundwater contamination and incomplete characterization of the DNAPL source area, as well as the heterogeneity of the shallow groundwater aquifer, it was determined to be prudent to initiate the groundwater cleanup in two stages. First, an interim remedial action will address the groundwater contamination outside of the source area while hydraulically containing groundwater in the source area. Second, the final remedial action will address the containment or removal of the DNAPL and groundwater contaminants in the source area. All environmental issues, including the documentation of the soil removal action, will be addressed in the final ROD for the Brandywine site. This IROD documents the alternative chosen as the interim remedial action.

The selected interim remedial action for groundwater at the site is Bioaugmentation and Carbon Substrate Addition with Gradient Control. The major components of the selected interim remedial action and the overall cleanup strategy to address contaminated groundwater at Brandywine are as follows:

- Inject a carbon substrate and naturally-occurring microbes (used in the treatability study) into the subsurface to accelerate the natural biodegradation of VOCs;
- Use one groundwater extraction trench in the plume source area to control the hydraulic gradient of groundwater and control the migration of DNAPL;
- Use the data generated by implementing and monitoring this interim remedial action to investigate the DNAPL source area(s) to better define the areal extent of the DNAPL;
- Implement and maintain institutional controls (ICs) in the form of groundwater and land use restrictions until the final remedial action is implemented in accordance with the final ROD. The USAF is responsible for implementing, monitoring, maintaining, and enforcing the ICs; the ICs will depend, in part, upon implementation of local regulations by Prince George's County (see 2.12.2.4 for more details on ICs); and
- Determine the final component of the groundwater remedial action for the contaminant source area.

The timeframe to achieve the cleanup criteria (MCLs) for the non-source area is estimated to be 7 years. The timeframe can be refined further as more data are collected as part of the groundwater monitoring component of this interim remedial action, which consists of sampling of 18 existing monitoring wells and 14 new monitoring wells installed at Brandywine. The data from the groundwater monitoring program will be used to evaluate and calculate the degradation rate and mass reduction of COPCs due to the injection of the substrate and microbes and to determine the efficiency of the groundwater extraction system. At a minimum, groundwater monitoring will be on a quarterly basis for the first two years, on a semi-annual basis during years three and four, and annually in years five through seven.

The selected interim remedial action will address groundwater contamination at Brandywine and fits into the overall strategy to investigate and appropriately address the 27 Environmental Restoration Program (ERP) sites and six areas of concern (AOCs) at Andrews Air Force Base (AFB) and its satellite facilities. The actions described in this IROD will be performed under the authority of USAF and USEPA, in coordination with MDE. While the selected interim remedial action is addressed under this IROD, it should be understood that the interim remedial action is integral to a comprehensive and final solution for groundwater cleanup at the site.

This alternative calls for the design and implementation of an interim remedial action to protect human health and the environment. The goals of this remedial action are to halt the spread of a contaminant plume, remove contaminant mass, collect data on aquifer and contaminant response to remediation measures and define the area containing DNAPL more accurately. The ultimate goal of remediation will be determined in a final remedial action for this site. This remedial action will be monitored carefully to determine the feasibility of achieving this goal with the method specified in this IROD (See OSWER Directive 9283.1-03, 10 October 1990).

1.5 STATUTORY DETERMINATIONS

The selected interim remedial action is protective of human health and the environment in the short term and is intended to provide adequate protection until the final remedial action is implemented in accordance with the final ROD. It complies with applicable or relevant and appropriate Federal and State requirements relevant to this limited-scope action and is cost-effective. Although this interim remedial action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this interim remedial action does utilize treatment and thus supports that statutory mandate. Although partially addressed by this interim remedial action, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element will be addressed by the final response action.

Because the selected interim remedial action will result in hazardous substances remaining on site above levels that allow for unlimited use and unrestricted exposure, a statutory review of the protectiveness of the selected interim remedial action will be conducted within five years following the initiation of the interim remedial action to ensure that the interim remedial action continues to be protective of human health and the environment.

The final remedial action will include the management of the DNAPL located in the source zone in the vicinity of the DRMO yard. Implementation of the interim remedial action selected in this IROD will not adversely affect, or be inconsistent with the selection of the final component of the groundwater remedial action. New data generated through implementation of the interim remedial action selected in this IROD will aid in specifying the final component of the comprehensive solution for treatment of groundwater at the site.

1.6 INTERIM ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this IROD. Additional information can be found in the Administrative Record file for Brandywine:

- Contaminants requiring remediation and their respective concentrations (Section 2.5.3);
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (Section 2.6);

- Baseline risk presented by all contaminants of concern (COCs) (Sections 2.7.2 through 2.7.4);
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the interim remedial action cost estimates are projected (Section 2.10);
- Methods for addressing principal threats (Section 2.11); and
- Key factor(s) that led to selecting the interim remedial action (Section 2.12.1).

1.7 AUTHORIZING SIGNATURES

The USAF and the USEPA select this interim remedial action with the concurrence of MDE.

Paul R. Ackerley, Colonel, USAF
Commander, 316th Wing
Andrews Air Force Base, Maryland

SEP 27 2006
Date

Abraham Ferdas, Director
Hazardous Site Cleanup Division
U.S. EPA, Region III

9/29/06
Date

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

The DRMO yard is an inactive facility administratively controlled by Andrews AFB located in Brandywine, Maryland, approximately 8 miles south-southeast of Andrews AFB (Figure 2-1). This property, which occupies approximately 8 acres, is bounded to the west by an active railroad track and to the east and north by wooded areas (Figure 2-2). Residential areas are located east, southeast, south, southwest, and west of the DRMO yard.

The DRMO yard is predominantly open and covered with grass. Remnants of former buildings and paved areas are also present. It was used from 1943 to 1987 as a storage area for waste and excess government material generated by the Navy and the Air Force. Historical activities conducted at the DRMO yard required the storage of organic solvents (VOCs) and material containing PCBs, which have contributed to site contamination (Dames & Moore, 1992a).

The National Superfund electronic database identification number for Brandywine DRMO, referenced by Andrews Air Force Base as Site SS-01, is MD9570024803. The USAF is the lead agency and provides funding from the Air Force environmental restoration account for the remedial action discussed in this IROD. This document is issued by the USAF (the site owner) and the USEPA (the federal regulatory agency responsible for overseeing compliance with CERCLA), in coordination with the MDE.

2.2 SITE HISTORY, ENFORCEMENT ACTIVITIES, AND INVESTIGATIONS

2.2.1 Site History

Past operational activities at the Brandywine DRMO have resulted in releases of hazardous substances to soil, sediment, surface water, and groundwater at the Brandywine site. Environmental investigations began in 1985 under the USAF's Environmental Restoration Program (ERP). The ERP, formerly called the Installation Restoration Program (IRP), was developed by the Department of Defense (DoD) in 1981 to identify, investigate, and clean up former disposal sites on military bases. The Brandywine site, which includes both the DRMO yard and portions of neighboring properties around the DRMO, was identified as an environmental site through the ERP.

According to USAF records, hazardous materials and wastes have not been stored at the DRMO yard since 1980. Prior to 1980, drums of waste solvents were stored at the DRMO yard, and several concrete bins located in the northeast area of the yard were used to store capacitors and transformers, some of which contained PCBs (Dames & Moore, 1991). The PCB contamination detected in the soil at the DRMO yard probably originated from with PCB-containing dielectric fluid from the capacitors and transformers stored at the yard. Detailed information on where solvent drums were stored and how wastes were managed at the DRMO yard is not available. There are no records of spills, leakage, or burial of wastes or PCBs at the yard (Dames & Moore, 1996). However, the results of soil and groundwater sampling provide documentation that releases of hazardous substances have occurred at the Brandywine DRMO.

2.2.2 Environmental Investigations

Environmental investigations have been conducted at the Brandywine site since 1985 and are being pursued under the USAF's ERP. The results of studies and investigations at Brandywine are summarized in Table 2-1 below.

Table 2-1
Environmental Investigations at the Brandywine Site.

Year	Investigation
1985	Phase I IRP Records Search (ES, 1985)
1988 to 1990	USGS Groundwater and Soil Investigation (USGS, 1991)
1991	HAZWRAP TCE Plume Delineation Study (Dames & Moore, 1992a)
1992	Pumping Test (Dames & Moore, 1992b)
1993 to 1994	Soil and Tank Removal Action (HNUS, 1995)
1996	HAZWRAP EE/CA (for groundwater treatment) (Dames & Moore, 1996)
1999	Groundwater Treatment System Operations and Emissions Test (IT, 1999)
2002 to 2003	Remedial Investigation (URS, 2005)
2006	EE/CA (for surface soil contamination) (URS, 2006a)
2006	Focused Feasibility Study (for groundwater contamination) (URS, 2006b)
2006	Groundwater Treatability Studies (URS, 2006c)

2.2.2.1 Current Remedial Action

In 1996, before the Brandywine site was added to the NPL, the Air Force constructed a groundwater treatment system at the northwest corner of the DRMO as part of the Hazardous Waste Remedial Action Program (HAZWRAP) (Dames & Moore, 1996a). The decision to construct the system was based on the *Decision Document for the Remediation of Trichloroethene Contaminated Groundwater at Brandywine Defense Reutilization and Marketing Office* (Dames and Moore, September 1996b). This system uses air stripping and carbon adsorption to remove VOCs. It consists of a 14-inch wide by 25-foot deep, 120-foot long groundwater extraction trench that is used to direct groundwater to a recovery well. Water from the well is treated on site in an air stripper, and the treated water is discharged into a drainage area on the east side of the CSX railroad. The treated water flows from the northwest corner of the DRMO yard in a northerly direction for 400 feet, and then through a culvert that conveys flow westerly under the railroad then through a second culvert that conveys flow westerly beneath Cherry Tree Crossing Road into wetlands. Water flowing through the wetlands eventually enters Timothy Branch creek, approximately 3,100 feet west of the DRMO yard.

Additional testing of the treatment system delayed its operation until 2000. The system has performed as effectively as it can since January 2000 under part-time operation. An estimated 507 pounds of VOCs were removed by December 2005 (URS, 2006b). Remediation is ongoing. The capture zone for the extraction trench does not control further migration of contaminants into residential areas because it is not ideally located (URS, 2006b). Groundwater contaminants observed in the residential area are not captured or treated by the existing system.

2.2.2.2 Remedial Investigation

A remedial investigation (RI) was completed in 2005 (URS, 2005). The RI evaluated the nature and extent of soil and groundwater contamination at the Brandywine site.

Groundwater samples from 30 shallow and two deep monitoring wells were sampled during the RI. Groundwater was analyzed at an additional 54 locations using cone penetrometer testing. The compounds TCE and PCE were found to be the most prevalent COPCs in groundwater at the site. The RI demonstrated that these contaminants form three distinct plumes in the groundwater. The COPCs were screened based on exceedances of EPA Region III risk-based screening levels (RBSLs) for contaminants in soil and groundwater and the EPA MCLs for groundwater. The analytical data were also compared to background levels of each analyte based on the analytical results for soil and groundwater at Brandywine (URS, 2005). The RI included an HHRA, which calculated the potential risks to human health from the contamination present at Brandywine. The results of the HHRA indicated that contamination in surface soil and groundwater poses an unacceptable risk to the health of future residents who may build homes upon the contaminated soil but that contamination in subsurface soil does not pose an unacceptable risk to human health. Current residences are located over dilute portions of the groundwater plume. The HHRA determined that current residents, commercial workers, and other potential current receptors do not face unacceptable health risks from exposure to the contaminated groundwater; however, sampling of indoor air is currently being undertaken to determine what, if any, risk may exist from vapor intrusion from the dilute portion of the plume. The results of the HHRA for both soil and groundwater are summarized further in Sections 2.7.1 through 2.7.4.

Potential ecological risks pertaining to the contaminants present at the Brandywine site were evaluated in the ecological risk assessment (ERA) included in the RI report (URS, 2005). Conclusions of the ERA indicated that PCB-1260, dieldrin, and several metals in surface soil posed a potential threat to ecological receptors. Soil cleanup is being addressed as a removal through an Engineering Evaluation/Cost Assessment (EE/CA) process (URS, 2006a). Results of the soil removal action will be summarized in the final ROD for the site.

2.2.2.3 Focused Feasibility Study

An FFS was undertaken in 2005 to evaluate remedial action alternatives that would, in part, address contamination associated with groundwater at the Brandywine site (URS, 2006b). The alternatives did not include response to the source area because the extent of the DNAPL source area(s) were not defined sufficiently in the RI. The FFS concluded that the COPCs in groundwater at the site are TCE, PCE, cis-1, 2-DCE, vinyl chloride, naphthalene, 2-methylnaphthalene, iron, and manganese. The TCE and PCE contaminants were likely released into the groundwater due to site activities. Vinyl chloride and cis-1,2-DCE are by-products of the biodegradation of TCE and PCE in the presence of petroleum hydrocarbons. While biodegradation breaks down the organic contaminants, it also causes changes in groundwater geochemistry that can cause the release of naturally-occurring iron and manganese from the aquifer’s solid formation to the groundwater. The connection between biological activity and the release of metals from the subsurface soils is demonstrated by the occurrence of the elevated concentrations of iron and manganese in approximately the same location as the highest concentrations of the organic contaminants (URS, 2006b). These metals are expected to precipitate to the aquifer’s solid formation once the aquifer returns to its natural geochemical conditions.

Remedial technologies that could be applied to the groundwater at the Brandywine site were screened in the FFS, which compared alternatives based on their effectiveness, implementability, and relative cost for treating the COPCs. Six remedial alternatives were developed in the FFS for the Brandywine site. These six alternatives were then analyzed in accordance with the nine criteria specified in the NCP at 40 CFR Section 300.430 (e)(9)(iii) to determine which alternative best meets the criteria. A summary of the remedial alternatives evaluated in the FFS and the alternative that has been selected as the Preferred Alternative are provided in this document.

2.2.2.4 Treatability Study

Two groundwater treatability studies were conducted at the Brandywine site in conjunction with the FFS to determine if enhanced in-situ biodegradation and/or chemical oxidation technologies were cost-effective for treatment of groundwater at the site. One study evaluated bioaugmentation (addition of dechlorinating bacteria) with the addition of different carbon substrates to facilitate the dechlorination process that may be injected into the groundwater. The carbon substrates studied in this treatability study include lactate (a proven soluble substrate) and vegetable oil (a slow-release substrate). Treatments and controls were simulated in microcosms containing site groundwater and sediment, to which various carbon substrates and amendments were added. The microcosms were inoculated with a commercially available dechlorinating bacteria culture, and sodium bicarbonate was added as a pH buffer. The purpose of this treatability study was to determine if lactate or vegetable oil would be comparable in effectiveness to the more costly, widely used and proven substrate Hydrocarbon Release Compound (HRC®). The HRC® technology was used as a representative in-situ biostimulation technology for the purpose of cost estimates in the FFS and this IROD.

Results of this treatability study indicated that vegetable oil provided the better treatment of vinyl chloride than lactate and reduced all of the chlorinated hydrocarbons to below their MCLs. Also, the inoculation of a dechlorinating culture and the addition of a pH buffer facilitate biodegradation. These results support the preferred alternative, Bioaugmentation and Carbon Substrate Addition with Gradient Control.

The second treatability study looked at different oxidants that may be injected for the chemical oxidation alternative. The chemical oxidation technologies tested included hydrogen peroxide, catalyzed persulfate, and potassium permanganate. Similar to the biotreatability study, site soil and groundwater samples were used in testing the effectiveness of oxidation technologies. The purpose of this study was to determine the most cost-effective reaction conditions and oxidant to be used if the oxidation technology is selected. Hydrogen peroxide in the form of Fenton's Reagent is used as a representative in-situ oxidation technology for the purpose of cost estimates in the FFS and this IROD.

The results of the chemical oxidation study were not as promising as those of the biotreatability study. The data indicate that multiple injections of oxidant would be required, thus increasing costs compared to the use of Bioaugmentation and Carbon Substrate Addition with Gradient Control.

2.2.3 Enforcement Activities

No enforcement activities have occurred at the Brandywine site. Environmental investigations have been conducted at the base since 1985 under the USAF's ERP, which identified the DRMO yard as an environmental site. On May 10, 1999, the USEPA listed the Brandywine site on its NPL. As a result, the USAF is working closely with USEPA, as well as MDE, to ensure that all possible risks at environmental sites at Andrews AFB and its satellite facilities, including Brandywine, have been evaluated and that the remedial alternative selected for each site is protective of human health and the environment.

2.3 COMMUNITY PARTICIPATION

Andrews AFB continues to conduct outreach to the local community stakeholders via several means, including periodic newsletters, a web page, and public notices on clean-up activities. In addition, the base closely coordinates with the Prince George's County Health Department on communications with the local community and has provided informational briefings to local stakeholders.

The RI and FFS reports and Proposed Plan for the Brandywine site were made available to the public in June 2006. They can be found in the Administrative Record file at Andrews AFB, Building 1419. The Administrative Record file was also made available to the public during the 30-day public comment period (June 23, 2006 to July 22, 2006) at the Clinton-Surratts Branch of the Prince George's County Memorial Library in Clinton, Maryland, which is located near Brandywine.

A notice of the availability of the RI, FFS, and Proposed Plan was published in the *Prince George's County Gazette* on June 22 and 29, 2006 and in the *Washington Post-Prince George's "Extra" weekly edition* on June 22, 2006. In addition, a public meeting was held on June 29, 2006, in Brandywine to present the Proposed Plan to interested community members. At this meeting, representatives from USAF, USEPA, MDE and the Prince George's County Health Department (PGCHD) were present to answer questions about the conditions at the site and the remedial alternatives. The USAF's and USEPA's responses to the comments received during the public comment period are included in the Responsiveness Summary, which is part of this IROD.

2.4 SCOPE AND ROLE OF RESPONSE ACTION

This IROD is prepared for the Brandywine site and is the third ROD prepared for environmental sites managed by Andrews AFB. The IROD summarizes several remedial alternatives evaluated for the cleanup of contaminated groundwater outside of the DNAPL source area at the Brandywine site, i.e., the aqueous and sorbed-phase contamination. Although the interim remedial action will provide treatment of the aqueous and sorbed-phase contamination within the DNAPL area, this alternative will not remove all of the DNAPL believed to be present within the source area. As the remediation progresses, the source area containing DNAPL will be more fully defined (URS, 2006b). The final remedial action for the DNAPL source area will be addressed in the final ROD for the Brandywine site.

The selected interim remedial action will address groundwater contamination at the Brandywine site and is consistent with the overall strategy to investigate and appropriately address the 27 ERP sites and six AOCs at Andrews AFB and its satellite facilities. The actions described in this IROD will be performed under the authority of USAF and USEPA, in coordination with MDE.

2.5 SITE CHARACTERISTICS

2.5.1 Physical Setting

The DRMO yard is located in Brandywine, Maryland, at a regional topographic high. This property occupies approximately 8 acres and is bounded to the west by an active railroad track and to the east and north by wooded areas. Residential areas are located east, southeast, south, southwest, and west of the DRMO yard. The majority of the properties surrounding the Brandywine DRMO are zoned residential. One of the three Gott properties and the Lewis property to the northwest are zoned commercial. The DRMO yard is predominantly open and covered with grass.

The geological formations encountered at the Brandywine site during the RI are (from top to bottom) the Brandywine, Calvert, and Nanjemoy Formations. Groundwater was encountered in the Brandywine Formation at a depth of approximately 2 to 15 feet below the ground surface. The Calvert Formation is located at depths of approximately 25 to 35 feet below the ground surface. The Calvert Formation consists of relatively impermeable silt and clay and acts as a barrier (or aquitard) to the downward movement of groundwater and contaminants. High groundwater levels occur near the northwest corner of the DRMO yard, where precipitation through the soil recharges the groundwater. The exact location, magnitude and extent of the groundwater elevations vary due to seasonal variations in precipitation (rainfall and snowfall). Groundwater flows radially from the highest groundwater elevation, although its velocity is not equal in all directions. The average groundwater flow rate was estimated at 35 feet per year (URS, 2005).

2.5.2 Conceptual Site Model

The conceptual site model (CSM) illustrates contaminant sources, release mechanisms, exposure pathways, migration routes, and potential receptors; it provides a basis for the risk assessments summarized in Section 2.7 of this IROD and, as a result, the basis for necessary response actions. A CSM outlining exposure pathways for potential human receptors at Brandywine is presented in Figure 2-3. Human receptors evaluated for exposure to contaminants in soil and groundwater (including vapors originating from VOCs in the groundwater) at the Brandywine site include hypothetical future residents, current residents, future commercial workers, construction workers, other workers, and trespassers/visitors.

Residences and businesses in the area of the plume obtain their water supplies from the local municipal distribution system, as specified by the Prince George’s County 10-Year Water and Sewer Plan (PGC, 2006). In addition, the State of Maryland prohibits the drilling of any new wells for potable use where municipal water supply is available (COMAR Section 26.03.01.05.A). There are no current receptors in the area of the plume that come in contact with groundwater at the Brandywine site although several homes have private wells that are located beyond the plume. USEPA and MDE categorize the beneficial use of the groundwater at the Brandywine site as a potential drinking water source. Therefore, the HHRA evaluated potential residential use of groundwater as drinking water by future receptors, although this scenario is unlikely. Current and potential future land and resource uses are discussed further in Section 2.6. Potential risks to human health are identified in Section 2.7.1 through 2.7.4.

Exposure pathways for ecological receptors were not included in Figure 2-3. Groundwater does not reach the surface at the Brandywine site. Therefore, the groundwater contaminants addressed by this IROD do not contribute to ecological risks. Potential ecological risks pertaining to the contaminants present in soil at the Brandywine site were reported in the Brandywine RI report (URS, 2005) and the EE/CA (URS, 2006a).

2.5.3 Nature and Extent of Contamination

The extent of groundwater contamination at the Brandywine site is discussed in depth in the Brandywine RI report (URS, 2005) and summarized here. The most significant groundwater contaminants at the site, as defined by areal extent and concentrations above the MCLs for federal drinking water standards, are TCE, PCE, and cis-1,2-DCE. Vinyl chloride, naphthalene, 2-methylnaphthalene, iron, and manganese were also identified as COCs in the RI.

The maximum concentration of TCE measured at the site was 224.2 mg/L. The MCL for TCE is 0.005 mg/L. Lateral contamination of TCE extends to the west, northwest, and southwest from the northwest corner of the DRMO yard (Figure 2-4). The area of highest contaminant concentrations occurs mainly to the northwest of the DRMO yard. A smaller, disconnected area of contamination occurs within the DRMO yard in the vicinity of monitoring well DP17. Additionally, an isolated area of TCE contamination occurs north of the DRMO yard in the vicinity of hydrocone sample location DL42. Contamination is present vertically throughout the Brandywine Formation, and the contaminant concentrations within the Brandywine Formation generally increase with depth. Elevated levels of VOCs, including TCE, also were detected in the uppermost portions of the Calvert Formation.

The PCE contamination occurs in two separate groundwater plumes, similar to the TCE contamination. A relatively small plume is located within the DRMO yard in the vicinity of monitoring well DP17 and a larger plume exists west of the DRMO yard. The larger PCE plume is limited in extent in comparison to the TCE plume (see Figure 2-4). The PCE contamination is very low (<0.10 mg/L) or absent in the region northwest of the DRMO yard where the highest levels of the TCE contamination were observed. The maximum concentration of PCE measured at the site was 0.349 mg/L. The MCL for PCE is 0.005 mg/L.

The main region of cis-1,2-DCE contamination is approximately collocated with the highest region of TCE contamination, trending to the northwest. The maximum cis-1,2-DCE concentration measured at the site was 13.4 mg/L. The MCL for cis-1,2-DCE is 0.070 mg/L. Comparatively minor cis-1,2-DCE contamination occurs within the DRMO yard around DP17 and north of the DRMO yard near DL42 (Figure 2-5).

Vinyl chloride contamination also is approximately collocated with the highest concentrations of cis-1,2-DCE, stretching northwest from the northwest corner of the DRMO yard (Figure 2-6), but the concentrations of vinyl chloride are two orders of magnitude less than those for cis-1,2-DCE. The highest measured vinyl chloride concentration was 0.189 mg/L. The MCL for vinyl chloride is 0.002 mg/L.

Iron and manganese were likely released from the aquifer as biodegradation of organic contaminants occurred over the history of releases at the site. The maximum concentrations of iron and manganese were measured at 17.6 mg/L and 1.49 mg/L, respectively. These concentrations were above background levels of 0.968 mg/L for iron and 0.066 mg/L for manganese at locations adjacent to or within the area of the highest TCE concentrations at the northwest corner of the DRMO yard as shown on Figures 2-7 and 2-8 (URS, 2006b). This area also is characterized by historically high rates of biodegradation of the organic contaminants, which has resulted in pH of less than 4.5 (Figure 2-9) and high chloride concentrations (Figure 2-10). In areas outside of this region, aerobic conditions exist and concentrations of dissolved iron and manganese are not elevated. The FFS contains details of the groundwater chemistry and its impact on ORP, pH, alkalinity and dissolved metals.

The area of groundwater contaminated by semivolatile compounds (SVOCs) is much more limited in extent than the area contaminated by VOCs. The SVOCs 2-methylnaphthalene and naphthalene were detected in concentrations significantly above the laboratory method detection limit (MDL) in only two monitoring wells (DP24 and PW01) and their concentrations are shown on Figure 2-11. The SVOC concentrations were found within or adjacent to the 10,000 µg/L isoconcentration contour for TCE (Figure 2-11). Therefore, the occurrence of SVOCs in groundwater at the Brandywine site is limited to the areas of highest VOC contamination. No MCLs have been established for 2-methylnaphthalene and naphthalene.

The mass of TCE and PCE dissolved in groundwater and sorbed to the solid matrix formation was estimated based on the extent of contamination as predicted by a groundwater model. The estimated mass of TCE and PCE in the Brandywine and Calvert Formations is shown in Table 2-2; details of the mass estimates are provided in the FFS (URS, 2006b). As discussed in the FFS, the elevated concentrations of TCE found in groundwater at the Brandywine site and the identification of DNAPL in at least one borehole indicate that TCE is present as DNAPL in groundwater.

However, the mass and areal extent of DNAPL is unknown at this time. Excluding mass of DNAPL, there are approximately 139 kilograms (kg) of TCE in the groundwater; similarly, there are an estimated 3.41 kg of PCE in the groundwater.

Table 2-2
Mass of TCE and PCE

Contaminant and Phase		Mass in Brandywine Formation (kg)	Mass in Brandywine and Calvert Formations (kg)
TCE	Dissolved	50	69
	Sorbed	51	70
	DNAPL	Unknown	Unknown
	Total	>101	>139
PCE	Dissolved	0.70	0.87
	Sorbed	2.05	2.54
	DNAPL	0	0
	Total	2.75	3.41

DNAPL = dense non-aqueous phase liquid
TCE = trichloroethene PCE = tetrachloroethene kg = kilogram

2.6 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

The DRMO yard, which occupies approximately 8 acres, is bounded to the west by an active CSX railroad track and to the east and north by wooded areas. Residential areas are located east, southeast, south, southwest, and west of the DRMO yard. Most of the properties surrounding the Brandywine DRMO are zoned residential. One of the three Gott properties and the Lewis property are zoned commercial. Current and future use of the Brandywine DRMO parcel will be limited to commercial use.

The groundwater in the immediate vicinity of the plume at the Brandywine site is not currently used for drinking, washing, or industrial uses because the area is served by public water supplied by Washington Suburban Sanitary Commission (WSSC). New developments located within the envelope of the County 10-Year Water and Sewer Plan (PGC, 2006) are required to connect to public water supplies. In addition, the contaminated groundwater does not discharge to surface water.

Because all current residences in the immediate vicinity of the plume receive potable water from the local municipal distribution system and Prince George's County prohibits the drilling of any new wells for potable use in the Brandywine area, there are no current receptors that could potentially come in contact with groundwater at the Brandywine site. The only potentially complete exposure pathway to groundwater contaminants is inhalation of vapors emanating from groundwater that migrate into the ambient air or into basements of buildings (indoor vapor intrusion). Vapor inhalation was estimated by modeling vapor transport to human receptors as part of the HHRA. The HHRA determined that current residents, commercial workers, and other potential current receptors do not face unacceptable health risks from exposure to vapor emanating from the contaminated groundwater; nevertheless, sampling of indoor air is currently being undertaken to determine what, if any, risk may exist from vapor intrusion for current residents living over or near the dilute portion of the plume. Results have not been generated by the laboratory at this time. Once vapor results are received, the potential risks due to vapor intrusion will be recalculated. If an unacceptable risk is determined through review of the sampling results, the AF will consult with EPA on appropriate actions to mitigate the risk. The selected remedy to treat groundwater will mitigate risks due to vapor intrusion.

Results of the HHRA indicated that groundwater would pose unacceptable health risks to future residents who reside over the source area of the groundwater contaminant plume if the groundwater were used as a source for drinking and showering. The unacceptable risks would be due to ingestion of and dermal contact with all eight COPCs in groundwater used as a drinking water supply and due to inhalation of TCE, PCE, and naphthalene vapors while showering with groundwater. There is no unacceptable health risk to a current resident from drinking or showering with water obtained from existing municipal water supplies. Because municipal water supply is available and drilling of new drinking water wells is prohibited, it is unlikely that groundwater at the Brandywine site would be used for drinking or showering in the future. Those residences or businesses that are currently using water from existing wells in the Brandywine area are located significantly beyond the extent of the groundwater plume shown on Figure 2-4.

2.7 SUMMARY OF SITE RISKS

The baseline risk assessment estimates what risks the site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. Because this IROD is focused on a portion of the comprehensive remedial action for groundwater, only the risks due to exposure to contaminants in groundwater will be presented. The results of the HHRA and ERA, including the risks due to exposure to soil and groundwater, will be presented in the final ROD.

A baseline HHRA was conducted for soil and groundwater and the methodologies and results are documented in the Brandywine RI report (URS, 2005). The reasonable maximum exposure (RME) scenario was evaluated for each potential receptor. The RME scenario represents a conservative level of human exposure and is intended to be most protective of human health. The central tendency exposure (CTE) scenario was evaluated to provide additional information. The CTE scenario portrays the median exposure estimate and corresponding risk rather than upper limit or reasonable maximum exposure estimate. The following subsections summarize the various risk assessments conducted for the Brandywine groundwater. Soil contamination is being addressed under a non-time-critical removal action, and the site risks related to surface and subsurface soil are documented in the Brandywine RI report (URS, 2005) and summarized in the Brandywine EE/CA report (URS, 2006a).

An ERA was also conducted for the Brandywine site and the methodologies and results are presented in Section 6 of the Brandywine RI report (URS, 2005) Since contaminated groundwater does not discharge to surface water, ecological receptors are not exposed to contaminants in groundwater. Therefore, the groundwater contamination at the site does not present a risk to ecological receptors. Additional information on the ERA as it relates to soil remediation is presented in the Brandywine EE/CA report (URS, 2006a).

2.7.1 Identification of Contaminants of Concern

The selection of COPCs is a conservative screening process that identifies those chemicals that may be present at the site at concentrations that could result in risks to potential receptors. The COPC selection process was conservative to ensure that potential risks were not overlooked at this early stage in the HHRA. The maximum-detected concentration of each constituent in each medium (surface soil, subsurface soil, and groundwater) was compared to a screening value to select the COPCs. If the maximum-detected concentration of a constituent exceeded the screening value, the constituent was selected as a COPC and retained for further evaluation. The USEPA Region III RBSLs for residential land use, RBSLs for tap water, and recommended daily allowances for essential nutrients were used as the screening levels to identify COPCs (URS, 2005). These RBSLs are chemical concentrations, based on standard default exposure assumptions, that correspond to an excess lifetime cancer risk of 1×10^{-6} (a 1 in 1,000,000 chance of developing cancer over a 70-year lifetime) or a noncancer Hazard Index (HI) of 1.0 (the threshold level below which non-cancer health effects are not expected to occur). Chemicals eliminated from further evaluation at this step present minimal risks to exposed human receptors. The COPCs were then further evaluated by comparing the COPC concentrations to the site background levels for soil and groundwater. Site-related COPCs were determined as those chemicals with concentrations that were significantly greater than background concentrations. The site-related COPCs were retained for the evaluation of site-related risk.

The COCs are a subset of the COPCs. The COCs were identified in the Brandywine FFS as those site-related chemicals needing to be considered for a response action because they contribute to a significant excess cancer risk or noncancer hazard (URS, 2006b). The COCs and exposure-point concentrations used to evaluate the RME scenario for groundwater are presented in Table 2-3. The exposure-point concentrations were used to estimate the risks contributed by each COC in the groundwater. The table includes the range of groundwater concentrations detected in groundwater monitoring wells during the RI for each COC, the detection frequency, and the statistical method used to determine the exposure-point concentration. The COCs in groundwater at the Brandywine site include TCE, cis-1,2-DCE, PCE, vinyl chloride, naphthalene, 2-methylnaphthalene, iron, and manganese. For TCE, the maximum concentration detected in monitoring wells was used for the exposure-point concentration. For the remaining seven COCs, the 95 percent upper confidence limit was used as the exposure-point concentration. The exposure concentrations used for the CTE scenario can be found in Appendix E of the RI report (URS, 2005).

Table 2-3
Chemical of Concern and Exposure Point Concentration

Contaminants of Concern	Groundwater Concentration Range[1] (µg/L)	Detection Frequency	Exposure-Point Concentration (µg/L)	Statistical Measure	Primary Drinking Water MCL (µg/L)
TCE	0.5 - 57,300	34/34	57,300	MAX	5
cis-1,2-DCE	1.36 - 13,400	34/34	7,180	95% UCL	70
PCE	0.11 - 118	Aug-34	16.9	95% UCL	5
Vinyl Chloride	0.14 - 10.8	25/34	3	95% UCL	2
Naphthalene	1.9 - 215	17-Aug	41	95% UCL	NA
2-Methylnaphthalene	1.8 - 157	17-Jun	42	95% UCL	NA
Iron	44 - 17,600	17/17	7,360	95% UCL	NA
Manganese	13 - 1,490	15/15	313	95% UCL	NA

[1]Data of samples collected from monitoring wells in 2002 and 2003 during the RI were used to determine the exposure-point concentration.
95% UCL = 95% Upper confidence limit MCL = Maximum contaminant level
MAX = Maximum concentration NA = Not available

2.7.2 Exposure Assessment

The exposure assessment defines and evaluates the type and magnitude of human exposure to the chemicals present at a site or migrating from a site. The exposure assessment depicts the physical setting of the site, identifies potentially exposed populations, and estimates chemical intakes under the identified exposure scenarios.

The groundwater at the Brandywine site is not currently used for drinking, washing, or industrial uses because the area is served by public water supplied by WSSC. New developments located within the envelope of the County 10-Year Water and Sewer Plan are required to connect to public water supplies. Groundwater usage beyond the perimeter of contaminated groundwater has been documented during surveys conducted by the USAF and PGCHD as part of the RI. The surveys determined that contaminated groundwater is not being used as potable water (URS, 2005). In addition, the contaminated groundwater does not discharge to surface water.

The compilation of contaminant sources, potentially complete exposure pathways, and potential receptors is depicted in the CSM in Figure 2-3. The human health risks for exposure to contaminated groundwater at the Brandywine site were evaluated for the following receptors and exposure pathways:

- Current resident: ingestion of, dermal contact with, and inhalation of volatiles from groundwater obtained from wells finished in the Brandywine formation and used as a source for drinking and showering; and inhalation of vapor that migrated from groundwater to air within residences (vapor intrusion).

- Future resident: ingestion of, dermal contact with, and inhalation of volatiles from groundwater used while showering with groundwater; and inhalation of vapor that migrated from groundwater to air within residences (vapor intrusion).

- Construction worker: inhalation of vapor that migrated from groundwater to ambient air.

- Future commercial worker: inhalation of vapor that migrated from groundwater to air within commercial buildings.

Indoor air sampling has been conducted to further investigate the potential risk due to vapor intrusion. The Air Force is awaiting indoor air sampling results from the laboratory.

Ingestion of and dermal contact with groundwater for the other worker, trespasser/visitor, construction worker, and future commercial worker were considered but not quantified because these receptors were unlikely to ingest or come in contact with groundwater over a prolonged period of time.

Inhalation of vapor that migrated from groundwater to ambient air for the current resident, other worker, trespasser/visitor, and future commercial worker were considered but not quantified because these receptors were unlikely to inhale the vapors in any significant amount.

Inhalation of vapor that migrated from groundwater to indoor air for the other worker, trespasser/visitor, and construction worker were considered but not quantified because these receptors were assumed to be outdoors at all times and not shower on-site.

Inhalation of vapor from showering for the other worker, trespasser/visitor, construction worker, and future commercial worker were considered but not quantified because these receptors were assumed not to shower on-site.

The values of exposure parameters used to quantify exposure are presented in Appendix E of the Brandywine RI report (URS, 2005). Exposure factors used in the HHRA were compiled from USEPA sources and professional judgment when necessary as documented in the Brandywine RI report (URS, 2005).

2.7.3 Toxicity Assessment

This section provides toxicity values used for the characterization of the potential human health risks associated with the potential exposure to media at the Brandywine site. The toxicity assessment identifies the potential adverse health effects in exposed populations. Toxicity values used in the HHRA were obtained from sources in accordance with the USEPA policy on human health toxicity values. The sources of toxicity values are discussed in Appendix E of the Brandywine RI report (URS, 2005).

The toxicity value used to evaluate carcinogenic effects is the cancer slope factor (CSF). The CSF is an upper-bound estimate of the probability that a person will develop cancer over a lifetime based on a given dose. The toxicity value used to evaluate non-carcinogen effects is the reference dose (RfD). The RfD is an estimate of the daily exposure level for the human population that is unlikely to result in adverse health effects. For the TCE vapor intrusion risk estimate, the pre-2001 toxicity criteria were used. Indoor air sampling has been conducted to investigate further the potential risk presented by PCE, TCE, cis1,2-DCE, vinyl chloride and SVOCs as vapor intrusion. The Air Force is awaiting indoor air sampling results from the laboratory. If an unacceptable risk is determined through review of the sampling results, the AF will consult with EPA on appropriate actions to mitigate the risk.

2.7.4 Risk Characterization

The results of the exposure assessment and toxicity assessment were used to develop numerical estimates and characterize the potential health risks associated with site-related contamination.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. These risks are probabilities that usually are expressed in scientific notation (e.g., 1×10^{-6}). A lifetime excess cancer risk of 1×10^{-6} indicates that an individual receiving the RME dose of a contaminant has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This risk is referred to as “lifetime excess cancer risk” because it would be in addition to the risks of cancer individuals face from other causes, such as smoking or exposure to sun. The NCP at 40 CFR Section 300.430(e)(2)(i)(A)(*2*) indicates that a generally acceptable risk range for site-related exposures is 10^{-4} to 10^{-6}.

The potential for noncarcinogenic effects is evaluated by comparing the dose of a noncarcinogenic chemical to an established RfD for that chemical. An RfD represents a dose that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of the chemical dose to the RfD is called a hazard quotient (HQ). A HQ of less than 1 indicates that a receptor’s dose of a single contaminant is less than the RfD and that toxic noncarcinogenic effects from that chemical are unlikely. The hazard index (HI) is generated by adding the HQs for all COCs. A target organ HI is generated by adding HQ values for chemicals that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. A target organ HI of less than 1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI of greater than 1 indicates that exposure to site-related contaminants may result in adverse health effects.

The risk drivers for excess cancer and non-cancerous risks due to exposure to contaminated groundwater are presented in Tables 2-4 and 2-5. The risks are listed for each contaminant and for each exposure pathway. The risk estimates are based on an RME scenario and were developed by taking into account various conservative assumptions about the frequency and length of time during which a receptor would be exposed to contaminants in groundwater, as well as the toxicity of the contaminants. The excess cancer risk and hazard index for exposure to contaminants in groundwater exceeded EPA upper bound limits of acceptable risk.

Results of the HHRA indicated that groundwater would pose unacceptable health risks to future residents who reside over the most contaminated area of the plume (the DNAPL source area) if the groundwater were used as a source for drinking and showering. The unacceptable risks would be due to ingestion of and dermal contact with all eight COPCs in groundwater used as a drinking water supply and due to inhalation of TCE, PCE, and naphthalene vapors while showering with groundwater. In the most contaminated area of the plume, groundwater also may pose unacceptable risks to future residents and future commercial workers due to inhalation of TCE vapors that migrated upward from groundwater to indoor air (vapor intrusion). Indoor air sampling has been conducted to investigate further the potential risk due to vapor intrusion. The Air Force is awaiting indoor air sampling results from the laboratory. If an unacceptable risk is determined through review of the sampling results, the AF will consult with EPA on appropriate actions to mitigate the risk.

The total cancer risk from direct exposure to COCs in groundwater for the future resident and the future commercial worker are 1.9×10^{-2} and 9.1×10^{-4}, respectively. The risk levels indicate that if no clean-up action is taken, a future resident would have an increased probability of 2 in 100 of developing cancer as a result of site-related exposure to the COCs, and a future commercial worker would have an increased probability of 10 in 10,000 of developing cancer as a result of site-related exposure to the COCs. The total estimated hazard indices (non-cancer risk) for the future resident and the future commercial worker are 714 and 372, respectively. These risk levels indicate potential non-cancer effects could occur from site-related exposure to COCs in groundwater if no clean-up action is taken. The exposure to TCE in groundwater is the main risk driver for both cancer and non-cancer risks.

The estimated risks presented in Tables 2-4 and 2-5 for each COC and each exposure pathway, except TCE vapor intrusion, were in general agreement with EPA's risk estimates. The calculated risks for TCE vapor intrusion were much lower than the risks calculated by EPA due to the differences in toxicity criteria that were used. However, indoor air samples are currently being collected to provide a better understanding of the potential risks due to vapor intrusion.

There is no unacceptable health risk to a current resident from drinking or showering with the water currently supplied to their home. Because municipal water supply is available and drilling of new drinking water wells is prohibited, it is unlikely that groundwater at the Brandywine site would be used for drinking or showering in the future. Those residences or businesses that are currently using water from existing wells in the Brandywine area are located significantly beyond the extent of the groundwater plume.

Various factors throughout the risk assessment lead to uncertainty that can overestimate or underestimate the potential risk. For example, site-related groundwater contamination would be expected to decrease over time, but the risk assessment assumed that the concentrations would remain constant throughout the exposure period. The use of the 95 percent upper confidence limit (UCL) of the arithmetic mean or the maximum detected value to represent site concentrations is a

Table 2-4
Groundwater Risk Characterization Summary: Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Groundwater used for water supply	Tetrachloroethene	1.4E-04	--	4.8E-05	1.8E-04
			Trichloroethene	9.4E-03	--	9.5E-04	1.0E-02
			Vinyl chloride (prorated, 1)	3.0E-05	--	1.2E-06	3.1E-05
			Vinyl chloride (non-prorated, 2)	1.3E-04	--	4.1E-03	4.2E-03
			(Total)	9.7E-03	--	5.1E-03	1.5E-02
Groundwater	Air	Vapors from groundwater beneath future resident (3)	VOCs (Inhalation scenarios only)				
			Trichloroethene	--	1.5E-03	--	1.5E-03
			(Total)	--	1.5E-03	--	1.5E-03
Groundwater	Air	Vapors while showering with groundwater (4)	VOCs (Inhalation scenarios only)				
			Trichloroethene	--	2.9E-03	--	2.9E-03
			(Total)	--	2.9E-03	--	2.9E-03
Total Risk Across Groundwater							1.9E-02

Scenario Timeframe: Future
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Vapors from groundwater beneath future resident (1)	VOCs (Inhalation scenarios only)				
			Trichloroethene	--	9.1E-04	--	9.1E-04
			(Total)	--	9.1E-04	--	9.1E-04
Total Risk Across Groundwater							9.1E-04

(1) Prorated: averaged over entire lifetime
(2) Non-prorated: averaged over exposure duration
(3) Receptor assessed using the Johnson and Ettinger Model (URS, 2006b)
(4) Receptor assessed using shower model from Foster and Chrostowski (1987) (URS, 2006b)

Table 2-5
Risk Characterization Summary: Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Non-Carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Groundwater used for water supply	Iron	blood/liver/GI tract	1.6	--	0.015	1.58
			Manganese (non-food)	CNS	1.0	--	0.037	1.04
			2-Methylnaphthalene	respiratory	0.66	--	1.01	1.67
			cis-1,2-Dichloroethene	blood	46	--	2.52	48
			Trichloroethene	liver/kidney/developmental	611	--	50	661
			(Total)		660	--	54	714
Groundwater	Air	Vapors from groundwater beneath current residence (1)	VOCs (Inhalation scenarios only)					
			--	--	--	--	--	--
			(Total)		--	0	--	0
Total Hazard Index Across Groundwater								714

Total blood HI = 50 Total CNS HI =1.04 Total GI tract HI = 1.58 Total kidney HI = 661 Total liver HI = 662

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure	Chemical	Non-Carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Groundwater used for water supply	Iron	blood/liver/GI tract	0.67	--	0.0090	0.68
			Manganese (non-food)	CNS	0.43	--	0.021	0.45
			2-Methylnaphthalene	respiratory	0.285	--	0.59	0.88
			cis-1,2-Dichloroethene	blood	20	--	1.48	21
			Trichloroethene	liver/kidney/developmental	262	--	30	291
			(Total)		283	--	32	314
Groundwater	Air	Vapors from groundwater beneath current resident (1)	VOCs (Inhalation scenarios only)					
			cis-1,2-Dichloroethene	blood	--	1.80	--	1.80
			Trichloroethene	CNS/liver	--	54	--	54
			(Total)		--	56	--	56

Table 2-5 (Cont.)

Scenario Timeframe: Future
Receptor Population: Resident (continue from previous page)
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Non-Carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Vapors while showering with groundwater (2)	VOCs (Inhalation scenarios only)					
			2-Methylnaphthalene	respiratory tract	--	0.97	--	0.97
			Naphthalene	nasal	--	0.94	--	0.94
			(Total)		--	1.91	--	1.91
Total Hazard Index Across Groundwater								372

Total blood HI = 23.63 Total developmental HI = 291 Total kidney HI = 291 Total nasal HI =0.94
Total CNS HI = 54.47 Total GI tract HI =0.68 Total liver HI = 346 Total respiratory tract HI = 0.97

Scenario Timeframe: Future
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Non-Carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Vapors from groundwater beneath current resident (1)	VOCs (Inhalation scenarios only)					
			cis-1,2-Dichloroethene	blood	--	1.30	--	1.30
			Trichloroethene	CNS/liver	--	39	--	39
			(Total)		--	40	--	40
Total Hazard Index Across Groundwater								40

Total blood HI = 1.30 Total CNS HI = 38.6 Total liver HI = 38.6

(1) Receptor assessed in Adult Scenario using the Johnson and Ettinger Model (URS, 2006b).
(2) Receptor assessed using shower model from Foster and Chrostowski (1987) (URS, 2006b).

very conservative estimate. The groundwater in the majority of the plume shown on Figure 2-4 will have contaminant levels below the 95 percent UCL. Therefore, the calculated risks are higher than the actual risks. The combination of many other conservative assumptions (i.e., in the exposure assessment and in the toxicity assessment) will most likely result in an overestimate of risk at the site. The risk to human health is unlikely to be greater than that predicted by the risk assessment. Additional information on uncertainties in the risk evaluation can be found in Section 6 of the Brandywine RI report (URS, 2005).

2.7.5 Conclusions of Risk Assessments and Basis for Action

The risk assessment determined that, if groundwater at the Brandywine site were to be used as a potable source, based on its beneficial use designation, TCE, cis-1,2-DCE, PCE, vinyl chloride, naphthalene, 2-methylnaphthalene, iron, and manganese are present at concentrations in groundwater at the Brandywine site which could result in potential unacceptable risks to future residents and commercial workers. The TCE, cis-1,2-DCE, PCE, and vinyl chloride were present above their respective primary drinking water standards (maximum contaminant level, or MCLs). The MCLs have not been established for naphthalene, 2-methylnaphthalene, iron, or manganese. The RI and FFS concluded that TCE, cis-1,2-DCE, PCE, vinyl chloride, naphthalene, 2-methylnaphthalene, iron, and manganese represented potential risks that require remediation to restore beneficial uses of the aquifer. Vapor intrusion of TCE from the most contaminated portion of the groundwater plume potentially could pose an unacceptable health risk to future residents and future commercial workers if they were to build or work over the most contaminated portion of the plume. The Air Force is awaiting indoor air sampling results from the laboratory.

This IROD selects a response action to mitigate the risks potentially posed by TCE, cis-1,2-DCE, PCE, vinyl chloride, naphthalene, 2-methylnaphthalene, iron, and manganese in groundwater at the Brandywine site. The response action selected in this IROD is necessary to protect human health and the environment from actual or threatened releases of hazardous substances in the environment. This response action is a component of the final remedial action for the site.

2.8 INTERIM REMEDIAL ACTION OBJECTIVES

Based on the evaluation of the site conditions, the contaminants and their physical properties in groundwater, the risk assessments, and the applicable or relevant and appropriate requirements (ARARs), the following interim remedial action objectives (RAOs) for groundwater contamination at the Brandywine site were developed:

1. Protect current and future human receptors from exposure to contaminated groundwater and to vapor emanating from the contaminated groundwater.

2. Prevent further migration of the dissolved phase contaminant plume.

3. Reduce contaminant concentrations in groundwater outside of the DNAPL source area.

4. Constrain migration of groundwater affected by DNAPL through use of hydraulic controls.

5. Further define the location of the DNAPL source area(s) by monitoring the progress of the cleanup.

6. Maintain ICs to ensure that people are not exposed to contaminants in the groundwater until the final remedial action is implemented in accordance with the final ROD.

The remedial action selected for the site should attain these interim RAOs, which address the unacceptable risks from COCs present in groundwater at Brandywine. The interim RAOs are intended to ensure that potential future human receptors are not exposed to the contaminants in groundwater at the site (i.e., through drinking or contact during construction activities) or to unacceptable risk associated with the vapor emanating from the groundwater. In addition, the fifth interim RAO ensures that the concentrations of COCs are monitored over time to confirm that the magnitude of unacceptable risks to potential receptors decreases.

2.9 DESCRIPTION OF ALTERNATIVES FOR GROUNDWATER

Six remedial alternatives were developed in the FFS for Brandywine to address the COCs in the groundwater:

- Alternative 1: No Action
- Alternative 2: Institutional Controls and Monitored Natural Attenuation
- Alternative 3: Groundwater Extraction and Ex-Situ Treatment (Pump and Treat) Using Air Stripping
- Alternative 4: Bioaugmentation and Carbon Substrate Addition
- Alternative 5: In-Situ Chemical Oxidation
- Alternative 6: Bioaugmentation and Carbon Substrate Addition with Gradient Control

Although the interim RAOs do not include the goal of achieving MCLs in the groundwater at the Brandywine site, the remedial timeframe for each alternative was determined based on the time required to reach MCLs for VOCs in the groundwater outside of the DNAPL source area. In each of these alternatives, the current treatment system was assumed to be shut down, abandoned, and discarded due to its limited range of influence. Due to the presence of DNAPL in the source area, none of the alternatives would allow unrestricted use and unlimited exposure to contaminated groundwater. Therefore, each alternative would be subject to review not less than every five years.

2.9.1 Alternative 1: No Action

The No Action Alternative assumes no further action would be taken regarding contaminants in the groundwater. The current pump-and-treat system would be shut down, abandoned, and discarded. No institutional controls, such as land use control or access restriction, or long-term monitoring would be implemented. This alternative is required by the NCP for baseline comparison purposes.

Natural attenuation of the contaminant plume is expected to take more than 100 years. The groundwater affected by DNAPL in the source zone will not be hydraulically contained under this alternative and would continue to release contaminants.

2.9.2 Alternative 2: Institutional Controls and Monitored Natural Attenuation

The primary components of this alternative include:

- Implementation and maintenance of ICs in the form of land and groundwater use restrictions to limit access and future development.

- Monitored natural attenuation (MNA), consisting of biological, chemical, and physical processes that reduce contaminant mass, toxicity, mobility, volume, and/or concentration without the application of engineered remediation techniques.

As part of this alternative, the current pump-and-treat system would be shut down, abandoned, and discarded.

Published anaerobic degradation rates suggest that the Brandywine TCE plume could naturally attenuate to 5 µg/L in approximately 35 to 40 years (URS, 2006b). This estimate is based on the assumption that an adequate carbon donor source exists, dissolved oxygen is depleted, and there is no continuing source area. However, based on groundwater sampling data and the fact that the contaminant groundwater plume has been in existence for at least 25 years, it is believed that dechlorination is severely inhibited within the 10,000 µg/L isoconcentration contour at this site by (a) the low pH, which is linked to the low buffering capacity of the aquifer, and (b) the inadequate supply of electron donor compounds. Based on the site conditions, it is estimated that a more realistic remediation time for natural attenuation of the aqueous groundwater plume at this site is at least 100 years, provided the DNAPL within the 10,000 µg/L contour, which acts as a continuing source, is contained or removed. The DNAPL source area within the 10,000 µg/L isocontour cannot be treated to MCLs through MNA within the 100-year timeframe. The groundwater affected by DNAPL in the source zone will not be hydraulically contained under this alternative and would continue to release contaminants.

2.9.2.1 Groundwater Monitoring and Statistical Trend Evaluations

All performance monitoring points would be sampled to evaluate the effectiveness of MNA. Groundwater sampling parameters deemed to be effective for evaluating natural attenuation include field measurements (temperature, conductivity, pH, dissolved oxygen (DO), ORP, and water level measurements), as well as laboratory analysis for VOCs, SVOCs, anions, phospholipid fatty acids (PLFA), iron, manganese, total organic carbon (TOC), and alkalinity. Because 2-methylnaphthalene and naphthalene were detected with elevated concentrations only at monitoring wells DP24 and PW01, only these two wells will be monitored for SVOCs.

Due to high TCE concentrations and the presence of DNAPL in the source zone, the proposed long- term monitoring (LTM) program sampling duration for determining present worth costs of MNA is based on a 100-year monitoring period, although it could be much longer depending on the amount of DNAPL in the aquifer. The sampling frequency would be semi-annual for two years, annually through year 40, and then every five years thereafter. A 100-year monitoring period is used for cost- estimating purposes. During the design and implementation phase, modifications to the sampling frequency and analyte list may be required. The sampling frequency would be optimized through time but is assumed to be consistent throughout the remedial timeframe for conservative cost estimating purposes

2.9.2.2 Institutional Controls

Institutional controls, or administrative and legal restrictions on the use of land and groundwater, will be implemented at the Brandywine site by the USAF and by operation of local regulations implemented by Prince George's County. The ICs will remain in place until the final remedial action is implemented in accordance with the final ROD, but can be modified as new data are analyzed. The ICs will be re-evaluated as part of the final ROD for the Brandywine site.

The objectives of the ICs at the Brandywine site are the following:

- Ensure no potable use of potentially impacted shallow groundwater at the site until MCLs are met in order to limit exposure of residents to groundwater contaminants;

- Ensure that activities occurring within the areas identified within Figure 2-12 do not damage the monitoring wells, interfere with the ability to undertake required environmental monitoring or testing, or cause the plume to spread;

- Ensure that land use is consistent with remedial action objectives;

- Ensure that any proposed construction activities near the site are evaluated with regard to risks posed by contaminants at the site and the potential for construction and dewatering activities to exacerbate site conditions; and

- Ensure that any impacted groundwater that exceeds relevant regulatory criteria is appropriately managed and disposed of during construction activities.

The proposed ICs as identified on Figure 2-12 apply to areas within or near the contaminant plume and include restrictions on groundwater extraction for potable use, dewatering activities due to construction, and reviews of construction permits.

2.9.3 Alternative 3: Groundwater Extraction and Ex-Situ Treatment (Pump and Treat)

The primary components of Alternative 3 include:

- Construction of a new pump-and-treat system. Groundwater in the aqueous contaminant zone would be extracted and treated ex-situ. The groundwater affected by DNAPL in the source zone will be hydraulically contained under this alternative.

- Implementation of the institutional controls identified in Alternative 2 to limit access and exposure to the contaminated groundwater.

This alternative involves groundwater extraction and treatment of contaminated groundwater, aboveground treatment to remove all VOCs, including TCE and its degradation products, and discharge of the treated groundwater to surface waters When the new system is operational, the current pump-and-treat system would be shut down, abandoned, and discarded. This alternative will require the clearance of approximately 1.0 acre of wetland.

The influent and effluent to the treatment system would be monitored for VOCs, SVOCs, and dissolved metals. All extracted water and air discharges, if any, will be treated and monitored to meet ARARs before discharge to the environment. Air discharges would be monitored for airborne VOCs.

2.9.3.1 Groundwater Monitoring and Statistical Trend Evaluations

Groundwater would be monitored for VOCs, SVOCs, iron, and manganese, as well as standard field parameters. Because 2-methylnaphthalene and naphthalene were detected with elevated concentrations only at monitoring wells DP24 and PW01, only these two wells will be monitored for SVOCs.

It is anticipated that a groundwater extraction and treatment system would achieve MCLs in approximately 28 years. Therefore, the current performance monitoring program sampling frequency is based on a 31-year monitoring period, which assumes 28 years to achieve MCLs followed by three years of confirmation sampling. The entire monitoring well network would be sampled semi-annually during the first two years in order to establish temporal (seasonal) and spatial variability. The well network would then be sampled annually for years three through 31. The network may change over time depending on the rate of cleanup. The results of the long-term monitoring program will be used to update the CSM and the fate-and-transport model for the Brandywine site. Treatment system influent and effluent samples would be collected monthly during the operational life of the treatment system. Monthly monitoring of vapor into and out of the granulated activated carbon (GAC) unit also would occur. During the design and implementation phase, modifications to the sampling frequency and analyte list may be required.

2.9.3.2 Institutional Controls

Similar to Alternative 2, ICs would remain in place until the final remedial action is implemented in accordance with the final ROD. The ICs for Alternative 3 are the same as those described for Alternative 2.

2.9.4 Alternative 4: Bioaugmentation and Carbon Substrate Addition

The primary components of this alternative include:

- Injection of a carbon substrate and dechlorinating bacteria in all contaminant plume areas with concentrations of TCE or PCE above 5 µg/L. The plume areas containing TCE and PCE concentrations less than 5 µg/L would be allowed to naturally attenuate;

- Treatment of the DNAPL source area, but not necessarily to acceptable levels, over the active timeframe of this alternative;

- Implementation of the institutional controls identified in Alternative 2 to limit access and exposure to the contaminated groundwater.

As part of this alternative, the current pump-and-treat system would be shut down, abandoned, and discarded. This alternative will require the clearance of approximately 2.1 acres of wetland.

Bioaugmentation is the addition of dechlorinating bacteria to the groundwater that is treated with an organic substrate. For purposes of developing cost estimates, the cost of adding dechlorinating bacteria is included in the cost of HRC substrate. The in-situ biodegradation rate of chlorinated hydrocarbons can be accelerated using a substrate such as, but not limited to, lactate, vegetable oil, or HRC. The HRC is a proprietary product which slowly releases lactate when hydrated. HRC will be used in this document as a representative material for the family of organic electron donors (lactate, oil, molasses, etc.). A decision as to which substrate to use can be supported by the results of the treatability study (URS, 2006). As indigenous and augmented microorganisms metabolize the substrate, hydrogen and reducing conditions are generated in the groundwater, which accelerate reductive dechlorination. Through reductive dechlorination, PCE is converted to TCE, to DCE, to vinyl chloride, and finally to ethene. Chlorides are produced. The groundwater affected by DNAPL in the source zone will not be hydraulically contained under this alternative and would continue to release contaminants.

2.9.4.1 Groundwater Monitoring and Statistical Trend Evaluations

All performance monitoring points would be sampled and analyzed for VOCs, SVOCs, anions, methane, ethane, and ethene, PLFA, total /dissolved iron and manganese, TOC, alkalinity, sulfide, and field parameters. Because the biodegration process is stimulated by injection of substrate into the saturated zone, substrate breakdown products and metals also will be monitored.

For cost-estimating purposes, three years are estimated to achieve MCLs, based on vendor and literature data (Battelle, 2001 and 2002) and experience. The current performance monitoring program sampling frequency is based on a six-year monitoring period, which assumes three years to achieve MCLs followed by three years of confirmation sampling. At a minimum, the entire monitoring well network would be sampled four times during the first year, including a baseline sampling event prior to substrate and bacteria injections, plus sampling events after three, six, and nine months. Additional sampling events would occur at twelve months and eighteen months after the initial injections. The sampling event during month eighteen would serve as the baseline sampling event for the secondary injection event. For cost-estimating purposes, two sampling events across the monitoring well network are assumed following the secondary injection, although the secondary injection would occur over a smaller area. The confirmation sampling will be conducted annually in years 4 through 6. The results of the long-term monitoring program will be used to update the CSM and the fate-and-transport model for the Brandywine site. During the design and implementation phase, modifications to the sampling frequency and analyte list may be required based on the results of the substrate chosen and/or the efficacy of the treatment.

2.9.4.2 Institutional Controls

Similar to Alternative 2, ICs would remain in place until the final remedial action is implemented in accordance with the final ROD. The ICs for Alternative 4 are the same as those described for Alternative 2.

2.9.5 Alternative 5: In-Situ Chemical Oxidation

The primary components under this alternative include:

- Injection of oxidants into the saturated thickness of the entire contaminated plume. Oxidants typically applied to remediate contaminated groundwater include potassium permanganate, catalyzed persulfate, hydrogen peroxide, and Fenton’s Reagent (hydrogen peroxide combined with soluble iron).

- Implementation of institutional controls identified in Alternative 2 to limit access and exposure to the contaminated groundwater.

As part of this alternative, the current pump-and-treat system would be shut down, abandoned, and discarded. This alternative will require the clearance of approximately 0.4 acre of wetland.

A treatability study was conducted, utilizing site-specific contaminated media, to determine which reagent or family of reagents will treat contaminated groundwater at the Brandywine site most effectively. For alternative design and cost-estimating purposes, it is assumed that a modified Fenton’s Reagent will be used for this alternative. A different oxidant may ultimately be selected for this alternative if found to be more cost-effective and/or better able to meet MCLs than Fenton’s Reagent. Potential adverse effects of in-situ chemical oxidation include off-gassing and fugitive emissions, heat generation, formation of temporary toxic byproducts, and reduction in permeability due to formation of particulates.

The remedial goals are estimated to be achieved in 2 years under this alternative with three years of confirmation monitoring, if the source area is contained. These assumptions were used for cost-estimating purposes. The groundwater affected by DNAPL in the source zone will not be hydraulically contained under this alternative and would continue to release contaminants.

2.9.5.1 Groundwater Monitoring and Statistical Trend Evaluation

All performance monitoring points would be sampled and analyzed for VOCs, SVOCs, iron, manganese, alkalinity, and field parameters during the full-scale treatment of the plume. Sampling requirements for the pilot test would be determined during the planning of the pilot test.

The current performance monitoring program sampling frequency is based on a 5-year monitoring period, which assumes two years to achieve MCLs followed by three years of confirmation sampling. The entire monitoring well network would be sampled quarterly for the first two years, and confirmation sampling will be conducted annually in years three through five. During the design and implementation phase, modifications to the sampling frequency and analyte list may be required based on the results of the treatability study or pilot test. The results of the long-term monitoring program will be used to update the CSM and the fate-and-transport model for the Brandywine site.

2.9.5.2 Institutional Controls

Similar to Alternative 2, ICs would remain in place until the final remedial action is implemented in accordance with the final ROD. The ICs for Alternative 5 are the same as those described for Alternative 2.

2.9.6 Alternative 6: Bioaugmentation and Carbon Substrate Addition with Gradient Control

The primary components under this alternative include:

- Gradient control by groundwater extraction and above-ground treatment;
- Bioaugmentation with dechlorinating bacteria, as previously described in Alternative 4, Section 2.9.4, and carbon substrate addition in order to decrease the time required to achieve the remediation goals and to treat the DNAPL source zone;
- Permeable biostimulation barriers (PBBs) located around the groundwater extraction trench;
- Monitor the effectiveness of the interim remedial action and define the DNAPL source area for the final ROD; and
- Implementation of the institutional controls identified in Alternative 2 to limit access and exposure to the contaminated groundwater.

The influent and effluent to the treatment system would be monitored for VOCs, SVOCs, dissolved metals, and PLFA. All extracted water and air discharges, if any, will be treated and monitored to meet ARARs before discharge to the environment. Air discharges would be monitored for airborne VOCs.

The plume west of the PBBs and the plumes located north of and on the DRMO yard will be treated by a grid-based application of carbon substrate which serves as a biostimulant. The PBBs have two objectives. First, contaminated groundwater upgradient of the PBBs is treated by the PBBs as it moves toward the extraction trench. Second, substrate from the PBBs is advected downgradient into the more highly contaminated portions of the plume by the hydraulic action of the extraction trench. Installation of the PBBs would be less damaging to the land than grid injection because a smaller area would be deforested to install PBBs as compared to grid injection over a large area. The groundwater affected by DNAPL in the source zone will be hydraulically contained under this alternative. When the new system is operational, the current pump-and-treat system would be shut down, abandoned, and discarded. This alternative will require the clearance of approximately 1.7 acres of wetland.

2.9.6.1 Groundwater Monitoring and Statistical Trend Evaluation

All performance monitoring points would be sampled and analyzed for VOCs, anions, methane, ethane, ethene, PLFA, iron, manganese, TOC, alkalinity, and sulfides. Because the biodegradation process is stimulated by injection of substrate into the saturated zone, substrate breakdown products and metals also would be monitored. Naphthalene and 2-methylnaphthalene were detected with elevated concentrations only at monitoring wells DP24 and PW01, so only these two wells would be monitored for SVOCs. For cost-estimating purposes, four years are estimated to achieve MCLs. Therefore, the current performance monitoring program sampling frequency is based on a seven-year monitoring period, which assumes four years to achieve MCLs followed by three years of confirmation sampling. The entire monitoring well network would be sampled quarterly for the first two years, including a baseline sampling round prior to treatment, then semi-annually for years three and four. Selected monitoring wells in the grid injection areas may need to be monitored more frequently during years three and four if a secondary injection event occurs. The confirmation sampling will be conducted annually in years five through seven. The results of the long-term monitoring program will be used to update the CSM and the fate-and-transport model for the Brandywine site. Aboveground treatment system influent and effluent samples would be collected monthly during the operational life of the treatment system. Monthly monitoring of air emission, if any, also would occur. During the design and implementation phase, modifications to the sampling frequency and analyte list may be required based on the substrate chosen.

2.9.6.2 Institutional Controls

Similar to Alternative 2, ICs would remain in place until the final remedial action is implemented in accordance with the final ROD. The ICs for Alternative 6 are the same as those described for Alternative 2.

2.9.7 Common Elements and Distinguishing Features of Each Alternative

One significant element common to all alternatives is that contaminants would remain in the groundwater at the Brandywine site for some time at concentrations above those consistent with unlimited use and unrestricted exposure. Therefore, all alternatives would require five-year reviews. In addition, each alternative would utilize the same ICs until the final remedial action is implemented in accordance with the final ROD. A distinguishing feature of Alternative 2 is the focus on natural attenuation, rather than engineered remediation processes, which results in a long remediation period. Alternatives 4, 5, and 6 share a common reliance on subsurface injections as a key component of the remedial strategy and a similar remedial timeframe (less than ten years). Alternatives 3 and 6 both utilize hydraulic control of the contaminated groundwater, but the remedial timeframe of Alternative 3 is significantly longer than Alternative 6 (31 years versus 7 years).

Alternative 1 does not include measures to prevent potential receptors from accidental exposure to contaminants in groundwater. Therefore, this alternative is not protective of human health and the environment. Alternatives 2 through 6 treat the aqueous and sorbed-phase contamination at the site, and each would require further action under a final ROD to treat or contain the DNAPL source area.

The present worth costs of Alternatives 3, 4, and 6 are approximately \$6,000,000 (rounded to the nearest \$1,000,000), while the cost of Alternative 5 (\$8,400,000) is the significantly greater. The present worth cost of Alternative 2 (\$2,100,000) is significantly less than the cost of the other alternatives that may be protective of human health and the environment.

2.9.8 Expected Outcomes of Each Alternative

Under Alternative 1, unacceptable risks to human health and the environment would likely continue for more than 100 years.

Alternative 2 has an unreasonably long remedial timeframe (greater than 100 years), but exposure to contaminated groundwater would be limited due to the ICs. Because the potential for natural biodegradation of contaminants is uncertain and due to the presence of DNAPL, achieving a significant reduction in contaminant concentrations in the non-source areas may not be possible over a reasonable period of time.

Alternatives 3, 4, 5, and 6 are each expected to achieve MCLs outside the DNAPL source area within a reasonable timeframe. Alternatives 3 and 6 also provide hydraulic gradient control of the groundwater during the remediation period and serve to restrict expansion and migration of the COCs located in the highly contaminated area of the plume and limit recontamination of clean groundwater from the DNAPL source zone during the interim remedial action.

2.10 COMPARATIVE ANALYSIS OF ALTERNATIVES

Each remedial alternative should be developed to address potential threats to human health and the environment posed by contaminated groundwater. The alternatives were evaluated in detail in the FFS, the outcome of which is summarized here. (URS, 2006b) The NCP at 40 CFR Section 300.430(f)(1)(i), requires the alternatives be evaluated against the nine criteria listed below.

<u>Threshold Criteria</u>

1. Protection of human health and the environment
2. Compliance with ARARs

<u>Balancing Criteria</u>

3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility, and volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost

<u>Modifying Criteria</u>

8. State acceptance
9. Community acceptance

The first two criteria are requirements that must be met unless specific ARARs are waived. Alternatives must be protective and comply with ARARs to be considered for a remedial action. The next five criteria are balancing criteria, where the relative advantages and disadvantages of the criteria are evaluated. The final two criteria are modifying criteria, in which the state and the community express whether they support or oppose the alternatives. The last criterion is evaluated at the end of the public comment period when all of the public comments are available. Figure 2-13 presents and summarizes the NCP criteria.

The cost information is summarized in Table 2-6. The cost estimates for each alternative were developed using the Remedial Action Cost Engineering and Requirements (RACER) program and vendor quotes. The total present worth cost assumes the entire amount of money required to implement the alternative is invested today and the money accumulates interest over the life span of each alternative. Because the total present worth costs takes into consideration the interest rate available and the timeframe of each alternative, alternatives with longer life spans can have lower present worth costs than shorter life span alternatives.

Table 2-6
Alternatives Cost Comparison

	Capital Cost	O&M and LTM Cost	Periodic Costs	Total Present Worth Cost
Alternative 1	$0	$0	$538,000	$538,000
Alternative 2	$77,000	$1,719,000	$293,000	$2,089,000
Alternative 3	$1,253,000	$4,842,000	$123,000	$6,218,000
Alternative 4*	$5,595,000	$835,000	$25,000	$6,455,000
Alternative 5*	$7,792,000	$591,000	$25,000	$8,408,000
Alternative 6	$3,803,000	$2,013,000	$29,000	$5,845,000

*Assuming DNAPL is controlled.
Detailed cost estimates are provided in the FFS (URS 2006)

The compliance of the alternatives with each of the NCP criteria is provided in Table 2-7. The alternatives were then ranked relative to each other in Table 2-8. As seen in these tables, Alternative 1 does not satisfy the threshold criteria for protection of human health and the environment. Undertaking no action will not include ICs to prevent exposure to groundwater contaminants and will not reduce contaminant mass.

Alternative 2 was not selected as the interim remedial action at the Brandywine site due to its unreasonably long remedial timeframe (greater than 100 years). Because the potential for natural biodegradation of contaminants is uncertain and due to the presence of DNAPL, achieving a significant reduction in contaminant concentrations in the non-source areas may not be possible over a reasonable period of time if Alternative 2 is implemented.

Alternatives 3, 4, 5, and 6 are each expected to achieve MCLs outside the DNAPL source area within a reasonable timeframe. Alternatives 3 and 6 also provide hydraulic gradient control of the groundwater during the remediation period and serve to contain the DNAPL during the interim remedial action. Alternatives 3, 4, 5, and 6 highly or moderately satisfy all of the threshold and primary balancing evaluation criteria required by the NCP. However, Alternatives 3, 4, and 5 were omitted as the selected interim remedial action for the following reasons:

- The cost of Alternative 3 ($6,220,000) was slightly higher than the cost of Alternative 6 ($5,850,000), and the remedial timeframe for Alternative 3 (31 years) is considerably longer than that for Alternative 6 (7 years).

- Alternative 4 requires the clearance and revegetation of a larger area of wetlands (2.1 acres) as compared to Alternative 6 (1.7 acres). In addition, Alternative 4 is more expensive ($6,455,000) but requires approximately the same remedial timeframe as Alternative 6.

TABLE 2-7
Comparative Analysis of Remedial Alternatives Summary

Criteria	Alternative 1 No Action	Alternative 2 IC and MNA	Alternative 3 Pump and Treat	Alternative 4 Bioaugmentation and Carbon Substrate Addition	Alternative 5 In-Situ Chemical Oxidation	Alternative 6 Bioaugmentation and Carbon Substrate Addition with Gradient Control
Overall Protection of Human Health and the Environment	Does not include measures to prevent human exposure to contaminated groundwater. Does not meet the threshold criteria for protection of human health or environment.	Adequate protection of human health and the environment. Institutional controls would minimize risks of exposure to contaminated groundwater by residents; however, the risk for potential exposure will persist for at least 100 years.	Adequate protection of human health and the environment. Institutional controls would minimize exposure to residents.	Adequate protection of human health and the environment. Institutional controls would minimize exposure to residents.	Adequate protection of human health and the environment. Institutional controls would minimize exposure to residents.	Adequate protection of human health and the environment. Institutional controls would minimize exposure to residents.
Compliance with ARARs **(Final ARARs to be determined in final ROD)**	Not evaluated. Irrelevant because a threshold criterion was not met.	Would not comply with RAOs within a reasonable timeframe. Would be in compliance with action-specific and location-specific ARARs.	Would comply with RAOs within 31 years and would comply with action-specific and location-specific ARARs.	Would comply with RAOs within six years and with potential action-specific and location-specific ARARs. Approximately 2.1 acres of wetlands would be cleared and revegetated.	Would comply with RAOs within five years and with action-specific and location-specific ARARs. Approximately 0.4 acres of wetlands would be cleared and revegetated.	Would comply with RAOsithin seven years and with action-specific and location-specific ARARs. Approximately 1.7 acres of wetlands would be cleared and revegetated.
Long-Term Effectiveness and Permanence	Not evaluated. Irrelevant because a threshold criteria was not met.	Contaminant concentrations are not expected diminish to acceptable levels within a reasonable timeframe due to the existence of uncontained DNAPL. The potential for further anaerobic degradation is unknown; therefore, IC and natural attenuation may not be effective in the long run.	Residual risks would diminish to acceptable levels within 31 years, provided that the DNAPL source is removed, treated, or contained. The management of DNAPL is currently being evaluated.	Residual risks would diminish to acceptable levels within six years, provided that the DNAPL source is removed, treated, or contained. The management of DNAPL is currently being evaluated.	Residual risks would diminish to acceptable levels within five years, provided that the DNAPL source is removed, treated, or contained. The management of DNAPL is currently being evaluated.	Residual risks would diminish to acceptable levels within seven years, provided that the DNAPL source is removed, treated, or contained. Two technologies are utilized to treat DNAPL: 1) biostimulant will enhance dissolution and treatment of DNAPL; 2) a gradient will be exerted to sweep the DNAPL zone with the biostimulant, while removing the mobile phase of the DNAPL. The management of DNAPL is currently being evaluated.

Criteria	Alternative 1 No Action	Alternative 2 IC and MNA	Alternative 3 Pump and Treat	Alternative 4 Bioaugmentation and Carbon Substrate Addition	Alternative 5 In-Situ Chemical Oxidation	Alternative 6 Bioaugmentation and Carbon Substrate Addition with Gradient Control
Reduction of Toxicity, Mobility, or Volume Through Treatment	Not evaluated. Irrelevant because a threshold criteria was not met.	Treatment technologies not employed. Reduction of toxicity, mobility, and volume of contaminants through natural attenuation verified through long-term monitoring.	Expected to reduce significantly or eliminate toxicity, mobility, and volume of contaminants through groundwater extraction and ex-situ treatment verified through long-term monitoring. Would limit the mobility of groundwater contaminants through hydraulic control.	Expected to reduce significantly or eliminate toxicity and volume of contaminants through in-situ treatment of groundwater contaminants verified through long-term monitoring. However, the lack of hydraulic control of groundwater in the DNAPL source area would result in the re-contamination of the treated aquifer outside of the DNAPL source area during the interim remedial action.	Expected to reduce significantly or eliminate toxicity and volume of contaminants through in-situ treatment of groundwater contaminants verified through long-term monitoring. However, the lack of hydraulic control of groundwater in the DNAPL source area would result in the re-contamination of the treated aquifer outside of the DNAPL source area during the interim remedial action.	Expected to reduce significantly or eliminate toxicity, mobility, and volume of contaminants through ex-situ and in-situ treatment of groundwater contaminants verified through long-term monitoring. Would limit the mobility of groundwater contaminants through hydraulic control.
Short-Term Effectiveness	Not evaluated. Irrelevant because a threshold criteria was not met.	Minimal risk to the workers during sample collection and monitoring well installation. Effective in the short term because exposure to contamination would be minimized with implementation of ICs.	Potential risks to the remediation workers during trench construction can be minimized or eliminated through proper planning and safe practices. Effective in the short term because exposure to contamination would be minimized with implementation of ICs.	Potential risks to the remediation workers during substrate injection can be minimized or eliminated through proper planning and safe practices. Effective in the short term because exposure to contamination would be minimized with implementation of ICs.	Potential risks to the remediation workers during chemical injection can be minimized or eliminated through proper planning and safe practices. Effective in the short term because exposure to contamination would be minimized with implementation of ICs.	Potential risks to the remediation workers during trench construction and substrate injection can be minimized or eliminated through proper planning and safe practices. Effective in the short term because exposure to contamination would be minimized with implementation of ICs.
Implementability	Not evaluated. Irrelevant because a threshold criteria was not met.	Easily implemented.	Readily implemented. A pump-and-treat system is already in place at the Brandywine DRMO.	Anticipated to be easily implemented. However, the results of the treatability study will determine which materials will be required for bioaugmentation and substrate addition.	Anticipated to be easily implemented, but slightly more difficult than HRC injection due to chemical hazards. However, the results of the treatability study will determine which materials will be required for chemical oxidation. Potential adverse effects include off-gassing and fugitive emissions, heat generation, formation of toxic byproducts, and reduction in permeability due to formation of particulates.	Anticipated to be readily implemented. However, the results of the treatability study will determine which materials will be required for bioaugmentation and substrate addition.

Criteria	Alternative 1 No Action	Alternative 2 IC and MNA	Alternative 3 Pump and Treat	Alternative 4 Bioaugmentation and Carbon Substrate Addition	Alternative 5 In-Situ Chemical Oxidation	Alternative 6 Bioaugmentation and Carbon Substrate Addition with Gradient Control
Cost (present worth value, 2006 dollar, rounded to $1,000)	No cost Periodic (Five-Year Review): $538,000	Capital $77,000 LTM $1,719,000 Periodic $293,000 Total Present Worth: $2,089,000	Capital $1,253,000 O&M+LTM $4,842,000 Periodic $123,000 Total Present Worth: $6,218,000	Capital $5,595,000 LTM $835,000 Periodic $25,000 Total Present Worth: $6,455,000 (assuming the DNAPL in the source zone is controlled)	Capital $7,792,000 LTM $591,000 Periodic $25,000 Total Present Worth: $8,408,000 (assuming the DNAPL in the source area is controlled)	Capital $3,803,000 O&M+LTM $2,013,000 Periodic $29,000 Total Present Worth: $5,845,000
Remedial Timeframe based on reaching MCLs (aqueous and sorbed phases)	Time to reach MCLs is unknown (greater than 100 years).	Time to reach MCLs is unknown (greater than 100 years).	31 years: 28 years for remediation, followed by three years of confirmation sampling	Six years: three years for remediation, followed by three years of confirmation sampling assuming that the groundwater affected by DNAPL in the source zone is controlled.	Five years: two years for remediation, followed by three years of confirmation sampling assuming that the groundwater affected by DNAPL in the source zone is controlled.	Seven years: four years for remediation, followed by three years of confirmation sampling.
Overall Evaluation	Alternative 1 does not meet threshold criteria of protective of human health and the environment.	Alternative 2 is effective in the short-term. However, the potential for natural attenuation is unknown and the anticipated time for remediation is unknown (greater than 100 years) due to uncontained DNAPL.	Alternative 3 is effective in the long-term and provides adequate protection until the final remedial action is implemented. The potential for exposure is limited to 31 years of pump and treat operations.	Alternative 4 is effective in the long-term and provides adequate protection until the final remedial action is implemented.	Alternative 5 is effective in the long-term and provides adequate protection until the final remedial action is implemented. Expensive compared to the other alternatives. Potential adverse effects include off-gassing and fugitive emissions, heat generation, formation of toxic byproducts, and reduction in permeability due to formation of particulates.	Alternative 6 is effective in the long-term and provides adequate protection until the final remedial action is implemented. The potential for exposure is limited to seven years of pump and treat operations.

ARAR = applicable or relevant and appropriate requirements
DRMO = Defense Reutilization and Marketing Office
HRC = Hydrogen Release Compound
IC = institutional controls
LTM = long-term monitoring
MCL = maximum contaminant level
MNA = monitored natural attenuation
O&M = operation and maintenance
ROD = Record of Decision
VOC = volatile organic compound

Table 2-8
Ranking of Remedial Alternatives

Criterion	Alternative 1 No Action	Alternative 2 ICs and MNA	Alternative 3 Pump and Treat	Alternative 4 Bioaugmentation and Carbon Substrate Addition	Alternative 5 In-situ Chemical Oxidation	Alternative 6 Bioaugmentation and Carbon Substrate Addition with Gradient Control
Overall Protectiveness of Human Health and the Environment						
1. Human health	O	●	●	●	●	●
2. Environmental protection	O	●	●	●	●	●
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)						
1. Chemical-specific ARARs[1]	NA	NA	NA	NA	NA	NA
2. Action-specific ARARs	O	●	●	●	●	●
3. Location-specific ARARs	O	●	●	●	●	●
Long-Term Effectiveness and Permanence						
1. Magnitude of residual risk	O	O	●	●	●	●
2. Adequacy of controls and monitoring	O	O	●	●	●	●
Reduction of Toxicity, Mobility, or Volume Through Treatment						
1. Reduction of toxicity, mobility, or volume	O	O	●	⊗	⊗	●
2. Statutory preference for treatment	O	O	●	●	●	●
Short-Term Effectiveness						
1. Community protection	O	⊗	⊗	●	●	●
2. Worker protection	O	●	●	●	●	●
3. Environmental impacts	●	●	⊗	⊗	O	⊗
4. Time until action is complete[2]	Unknown (>100 years)	Unknown (>100 years)	31 years	6 years	5 years	7 years

Criterion	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Implementability						
1. Effort needed to implement	●	●	⊗	⊗	⊗	⊗
2. Reliability of technology	**NA**	**NA**	●	⊗	⊗	●
Cost[2,3]	$540,000	$2,090,000	$6,220,000	$6,460,000	$8,410,000	$5,850,000
State/Support Agency Acceptance	**O**	**O**	⊗	●	●	●
Community Acceptance	To be determined	To be determined	To be determined	To be determined	To be determined	To be determined
Overall Ranking	**O**	**O**	⊗	⊗	⊗	●

● Satisfies criterion to a high degree ⊗ Satisfies criterion to a moderate degree **O** Does not meet criterion

ARAR = applicable or relevant and appropriate requirements
IC = institutional controls
MNA = monitored natural attenuation
NA = not applicable
[1]Chemical-specific ARARs are not applicable to interim RODs (OSWER Directive 9283.1-03, 10 October 1990).
[2]Provided that groundwater affected by DNAPL in the source area is controlled for Alternatives 3 and 4.
[3]Cost is the total present worth value, rounded to $10,000

- The cost of Alternative 5 ($8.4 million) is significantly higher than that for Alternative 6 ($5.8 million), but the remedial timeframes for the two alternatives (5 and 7 years, respectively) are not significantly different.

- The lack of hydraulic control in the DNAPL source area in Alternatives 4 and 5 would result in the re-contamination of the aquifer treated outside of the DNAPL source area during the first phase of groundwater cleanup at the Brandywine site.

- Based on the criteria evaluation and ranking in Table 2-8, Alternative 6 was chosen as the selected interim remedial action by the USAF and USEPA and was presented to MDE and the public as such in the Proposed Plan. Comments on the Proposed Plan are used as the basis for evaluating the selected interim remedial action further against two modifying criteria:

1. State Acceptance
2. Community Acceptance

State Acceptance

MDE has provided a concurrence letter supporting Alternative 6 as the preferred interim remedial action for Brandywine (see Appendix A).

Community Acceptance

The public meeting in Brandywine on June 29, 2006 was attended by six members of the general public. No objections to the selected interim remedial action were presented in the public meeting or in written comments to the USAF during the public comment period (June 23, 2006 to July 22, 2006). The Responsiveness Summary (Section 3) summarizes comments or concerns raised by the public and the response to comments by the USAF and USEPA. A transcript of the public meeting is attached to this IROD as Appendix D.

2.11 PRINCIPAL THREAT WASTES

The NCP, at 40 CFR Section 300.430 (a)(1)(iii)(A), establishes an expectation that USEPA will use treatment to address "principal threats" posed by a site wherever practicable. The "principal threat" concept is applied to the characterization of "source materials" at NPL sites. A source material is material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air or acts as a source for direct exposure. Contaminated groundwater generally is not considered to be a source material. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. The DNAPL present in the subsurface at the Brandywine site is considered to be both a source material and a principal threat waste. The final remedial action for the DNAPL source area will be addressed in the final ROD for the Brandywine site. Because this interim action does not constitute the final remedial action for the site, the statutory preference for treatment that addresses principal threats, although partially satisfied by this interim remedial action, will be addressed by the final response action.

2.12 SELECTED INTERIM REMEDIAL ACTION FOR GROUNDWATER

The selected interim remedial action for the contaminated groundwater outside the DNAPL source area at the Brandywine site is Alternative 6. This section expands upon the details of the selected interim remedial action for Brandywine groundwater.

2.12.1 Summary of the Rationale for the Selected Interim Remedial Action

Based on the evaluation of the remedial alternatives, Alternative 6 is protective of human health and the environment and complies with the applicable ARARs. The superior benefits of Alternative 6 are associated with gradient control, which assures:

- Greater control of the aquifer cleanup as the groundwater gradient controls the conveyance of substrate through the aquifer towards the source zone where the planned extraction trench will be located;
- Hydraulic control of the groundwater in the DNAPL source zone until the final remedial action is implemented in accordance with the final ROD; and
- Cost-effective remediation of the groundwater plume compared to the other alternatives.

This alternative calls for the design and implementation of an interim remedial action to protect human health and the environment. The goals of this remedial action are to halt the spread of a contaminant plume, remove contaminant mass, collect data on aquifer and contaminant response to remediation measures and define the area containing DNAPL more accurately. The ultimate goal of remediation will be determined in a final remedial action for this site. This remedial action will be monitored carefully to determine the feasibility of achieving this goal with the method specified in this IROD (See OSWER Directive 9283.1-03, 10 October 1990).

Based on the evaluation of the remedial alternatives in the Brandywine FFS, the USAF and USEPA, with concurrence from MDE, select Alternative 6 (Bioaugmentation and Carbon Substrate Addition with Gradient Control) as the preferred alternative. No objections to the selected interim remedial action have been received from the public.

2.12.2 Description of the Selected Interim Remedial Action

The primary components of the selected interim remedial action are:

- Gradient control by groundwater extraction and aboveground treatment;
- Bioaugmentation and carbon substrate addition to the groundwater in order to decrease the time required to achieve the remediation goals and to treat the DNAPL source zone;
- Permeable biostimulation barriers located around the groundwater extraction trench; and
- Implementation of institutional controls to limit access and exposure to the contaminated groundwater.

The combined treatment scenario is illustrated in Figure 2-14. The portion of the plume captured by the extraction trench also is illustrated in Figure 2-14.

2.12.2.1 Gradient Control by Groundwater Extraction and Aboveground Treatment

The gradient control and treatment system will include one extraction trench. The extraction trench will be located in the most contaminated region of the plume, which is likely to be co-located with the DNAPL. The trench will be approximately 32 feet deep, 3 feet wide, and 220 feet long.

Hydraulic modeling results suggest that the aquifer could dewater at an extraction rate between 20 and 30 gallons per minute (gpm) (URS, 2006b). For this preliminary estimate, a 20-gpm extraction rate is assumed practical. Extracted groundwater would be treated to remove VOCs. The treated water will be filtered, if necessary, for suspended solids prior to discharge to a surface drain that connects to Timothy Branch.

During construction of the extraction trench some DNAPL may be removed and disposed. Inside the DNAPL source area, the contaminants in the aqueous phase will be extracted for ex-situ treatment. As the contaminant concentrations in groundwater are reduced, the DNAPL dissolution rate will increase due to the steeper concentration gradient being produced; in turn, the mass of DNAPL in the aquifer will decrease. The gradient control exerted by the extraction system will remove additional amounts of contaminants, possibly some mobile DNAPL, as well as the aqueous phase contaminants within the 10,000 µg/L isocontour. Although the aqueous-phase and sorbed-phase contamination in the DNAPL source zone will be treated, it is impractical to treat groundwater in this area to MCLs due to the presence of DNAPL. The final remedial action will address the management of the DNAPL located in the source zone.

The gradient control system is expected to run for approximately four years to reduce the aqueous plume inside the PBBs, the zone between 1,000 µg/L and 10,000 µg/L TCE, to MCLs (URS, 2006b). However, if substrate begins to enter the extraction system, as measured by PLFA analysis of the influent to the treatment system, then the gradient control system may be shut down temporarily until the substrate is consumed by the bacteria. The extraction and treatment system will continue to operate for groundwater gradient control until the final remedial action is implemented.

A description of the groundwater monitoring program and statistical evaluations of the data collected for VOCs, anions, methane, ethane, ethene, PLFA, iron, manganese, TOC, alkalinity, and sulfides in groundwater at Brandywine is presented in Section 2.9.6.1.

2.12.2.2 Bioaugmentation and Carbon Substrate Addition

A grid-based application, spaced approximately 20 feet apart within and between rows, will be employed to inject substrate to treat outlying plume areas on the DRMO yard and on the western end of the plume that would not be influenced by the extraction system, as shown in Figure 2-14. These grid injections will occur only in areas of the plume with concentrations of TCE or PCE above 5 µg/L. The substrate will be injected as deep as 30 feet below ground surface and about two feet into the Calvert formation near the source area. Dechlorinating bacteria will be injected following the injection of the substrate. It is likely that dechlorinating bacteria will only be injected once into the groundwater.

Approximately 284,483 square feet (6.5 acres) of the site will be treated by grid injection (URS, 2006b). Of the western plume area, approximately 74,100 square feet (1.7 acres) consist of wetlands. The grid injection area in the western plume will need to be cleared and revegetated. A total area of 134,900 square feet is expected to be cleared for grid and barrier injections under this alternative. Plume areas containing TCE and PCE concentrations less than 5 µg/L will be allowed to attenuate naturally. The grid injections are planned to occur at the beginning of the construction of the groundwater extraction trench. During that period (estimated to be approximately 6 months), the organic acids produced by the substrate will experience limited migration due to the natural groundwater flow and will move into the areas containing the less than 5 µg/L contaminant isoconcentration contours, promoting biodegradation in that region.

The need to reapply the substrate depends on site-specific biodegradation performance. It is assumed that two applications will be required in the areas of grid injection, with the second injection occurring approximately two years after the first in the region containing more than 5 µg/L of TCE or PCE, if attenuation is observed after the first injection. For the cost estimate, it is assumed that two applications will be required, with the second injection covering 50 percent of the area of the first grid injection, and requiring 25 percent of the material used in the first injection. The details of the design of the grid injections may change slightly based on the choice of substrate.

2.12.2.3 Permeable Biostimulation Barriers Located Around the Groundwater Extraction Trench

Permeable barrier-based (treatment zones or area) applications of substrate and bacteria will be employed, in concert with the groundwater gradient control system in areas of the main contaminant plume accessible to direct-push injection. Each PBB will comprise direct-push injections of substrate and bacteria in two rows spaced 10 feet apart, with the injections at 5-foot intervals. The length of each proposed PBB is shown in Figure 2-13. The use of long-lasting substrate in the PBBs eliminates the need for multiple applications of substrate in dense grid injections. In addition, the PBB injections require the clearance of a much smaller area as compared to grid injection of HRC. Figure 2-13 shows the proposed locations of the extraction trench, PBBs, and grid injection. The PBBs are intended to treat contaminated groundwater upgradient of the PBBs that is not treated by grid injection, thus reducing the volume of contaminated groundwater to be treated by the extraction system and reducing the overall remediation timeframe for the cleanup of the non-source area (the area outside the area containing DNAPL).

The details of design of the PBBs may change slightly based on the choice of substrate and/or underground utilities. The carbon substrate HRC was used in the cost analysis as representative material for the family of organic electron donors (lactate, oil, molasses, etc.) to develop the design of this alternative.

2.12.2.4 Institutional Controls

As discussed in Section 2.9.6.2, ICs are necessary to limit exposure to contaminated groundwater. The general areas for which ICs will be implemented are illustrated on Figure 2-12.

The IC Objectives are as follows:

- Ensure no potable use of potentially impacted shallow groundwater at the site until MCLs are met in order to limit exposure of residents to groundwater contaminants;

- Ensure that activities occurring within the areas identified within Figure 2-12 do not damage the monitoring wells, interfere with the ability to undertake required environmental monitoring or testing, or cause the plume to spread;

- Ensure that land use is consistent with remedial action objectives;

- Ensure that any proposed construction activities near the site are evaluated with regard to risks posed by contaminants at the site and with regard to the potential for construction and dewatering activities to exacerbate site conditions; and

- Ensure that any impacted groundwater that exceeds relevant regulatory criteria is appropriately managed during construction activities.

The USAF is responsible for implementing, monitoring, maintaining, and enforcing the ICs at the Brandywine site. The ICs will depend, in part, upon implementation of local regulations by Prince George's County. Any activity that is inconsistent with the IC objectives or use restrictions, or any other action that may interfere with the effectiveness of the ICs will be addressed by the USAF or brought to the attention of Prince George's County, if appropriate, as soon as practicable. The USAF will notify EPA and MDE regarding how the USAF has addressed or will address the breach within 10 days of sending EPA and MDE notification of the breach. The ICs can be modified as new data are analyzed; however, the USAF will not modify or terminate Land Use Controls (LUCs), implementation actions, or modify land use without approval by EPA and the MDE. The USAF will seek prior concurrence before any anticipated action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for LUCs.

The groundwater plume protrudes beyond the DRMO yard onto private properties. Implementation of state regulations and county ordinances by Prince George's County, which apply countywide, will be relied upon to protect private property owners and the public from groundwater that may contain hazardous substances.

By implementation of state regulations and county codes, Prince George's County has agreed to implement the following ICs at the Brandywine site:

- Review of groundwater well permits to regulate well drilling permits within and near the plume, in accordance with Code of Maryland Regulations (COMAR) Section 26.04.04.09.

- Review of plans for development, including construction of new buildings or additions to existing buildings, through the Permits and Review Division of Prince George's County Department of Environmental Resources (PGCDER), in accordance with Prince George's County Code, Subtitle 4, Sections 4-270 through 4-315.

The use of groundwater at the Brandywine site is currently restricted, as documented in the Prince George's County Ten-Year Water and Sewer Plan. Currently, all residences and businesses located within the immediate vicinity of the groundwater plume receive potable water from the WSSC. COMAR Section 26.03.01.05.A prohibits issuance of a permit to individual residents or businesses for private water supply wells when public water supplies are available, as in the case of the Brandywine site. Figure 2-12 illustrates a 500-foot buffer around the existing plume, which will be used during further discussions with the County.

The USAF shall implement the following ICs at the Brandywine site:

- Notify EPA and MDE at least six (6) months prior to any transfer or sale of Brandywine so that EPA and MDE can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective ICs. If it is not possible for the facility to notify EPA and MDE at least six months prior to any transfer or sale, then the facility will notify EPA and MDE as soon as possible but no later than 60 days prior to the transfer or sale of any property subject to ICs. In addition to the land transfer notice and discussion provisions above, the USAF further agrees to provide EPA and MDE with similar notice, within the same time frames, as to federal-to-federal transfer of property. The USAF shall provide a copy of executed deed or transfer assembly to EPA and MDE.

- Maintain records of the groundwater contamination at the Brandywine site in the Andrews AFB geographic information system/environmental database.

- Provide regular updates to PGCHD, PGCDER, and MDE regarding the extent of the plume and the required distance of wells and dewatering trenches from the edge of the plume for safe groundwater usage.

- Provide annual reports on the integrity and effectiveness of the ICs to the USEPA. These reports will be used in preparation of the five-year review to evaluate the effectiveness of the interim remedial action.

- Post signs on the DRMO yard identifying the site as a CERCLA site. The signs will summarize the nature of contamination at the site and will state that no construction or excavation activities and no groundwater use or withdrawal is permitted at the site without written authorization by the USAF. Contact information for the Andrews AFB ERP project manager and PGCHD will also be included on the signs.

The ICs will remain in place until the final remedial action is implemented in accordance with the final ROD. Monitoring of the environmental use restrictions and controls will be conducted annually by Andrews AFB. The monitoring results will be included in a separate report or as a section of another environmental report, if appropriate, and provided to USEPA and MDE for informational purposes only. The annual monitoring reports will be used in preparation of the five-year review to evaluate the effectiveness of the interim remedial action. The annual monitoring report will evaluate the status of the ICs and how any IC deficiencies or inconsistent uses have been addressed. Andrews AFB shall notify USEPA and MDE 45 days in advance of any proposed land use changes that are inconsistent with land use control objectives or the selected interim remedial action.

2.12.3 Summary of the Estimated Costs of the Selected Interim Remedial Action

The cost estimates were prepared in general conformance with EPA guidance (USEPA, 2000) and are based on direct experience associated with Brandywine and other sites at Andrews AFB and sites across the country. The cost estimates for each alternative were developed using the Remedial Action Cost Engineering and Requirements System (RACER) program and vendor quotes. The costs are presented in 2006 dollars. Expenditures that occur over different time periods are returned to present worth (2006 dollars), which discounts all future costs to a common base year. Present-worth analysis allows the cost of remedial action alternatives to be compared on the basis of a single figure representing the amount of money that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the life of the remedial action. Assumptions associated with the present-worth calculations include: a discounted rate of 2.6 percent for a 5-year timeframe, 2.7 percent for a 7-year timeframe, 2.8 percent for a 10-year timeframe, 3.0 percent a 20-year or longer timeframe (OMB, 2006), and that groundwater affected by DNAPL in the source area is hydraulically contained.

The total present worth cost of Alternative 6 is estimated at $5,845,000 over the predicted 7-year lifespan (4 years of remediation and 3 years of confirmation sampling) of the alternative. This cost includes capital costs for the installation of one trench, pumps, and treatment system; 545 direct-push injections of HRC in the grid injection areas; 150 direct-push injections of HRC/HRC-X in the PBBs; new monitoring wells, and the associated equipment and labor. In addition, costs for O&M, LTM, and five-year reviews are provided in Table 2-9. The accuracy of the cost estimate is expected to be within +50 percent to -30 percent; the cost estimate will be refined as the interim remedial action is designed and implemented. Additional detail on the cost assumptions for Alternative 6 is presented in the notes to Table 2-9. Detailed cost estimates are provided in the FFS (URS 2006)

TABLE 2-9

ALTERNATIVE 6 COST ESTIMATE

						Present Value [5]			
Year	Capital Cost[2]	O&M and LTM Cost[3]	Periodic Cost[4]	Annual Cost	Discount Factor	Capital Cost	O&M and LTM Cost	Periodic Cost	Total Present Value
0	3,241,936	12,000	-	3,253,936	1.000	3,241,936	12,000	-	3,253,936
1	-	469,082	-	469,082	0.974	-	456,750	-	456,750
2	591,650	469,082	-	1,060,732	0.948	560,949	444,742	-	1,005,691
3	-	300,323	-	300,323	0.923	-	277,254	-	277,254
4	-	300,323	-	300,323	0.899	-	269,965	-	269,965
5	-	215,944	32,816	248,759	0.875	-	189,011	28,723	217,735
6	-	215,944	-	215,944	0.852	-	184,042	-	184,042
7	-	215,944	-	215,944	0.830	-	179,204	-	179,204
TOTAL	3,834,000	2,199,000	33,000	6,065,000	-	3,803,000	2,013,000	29,000	5,845,000

1 Discount rate taken from Office of Management and Budget (OMB) Circular A-94, Appendix C, updated January 2006.
Real discount rate used (2.7%) is the discount rate given for 7-year projects.
2 Professional labor management was split (75% year 0 and 25% year 2). Landscaping and 2nd injection in year 2.
3 The costs include O&M cost and performance and compliance monitoring cost.
4 Periodic costs include five-year review (Year 5).
5 Present value derived using EPA guidance (USEPA, 2000).

2.12.4 Estimated Outcomes of the Selected Interim Remedial Action

The DNAPL source area will be contained through hydraulic controls as the aqueous phase of the plume is being treated. Additionally, the locations likely to contain DNAPL will be treated over the active timeframe of this alternative. Thus, the DNAPL will not recontaminate the treated area during the extraction timeframe. This alternative also will minimize destruction of trees and other vegetation by limiting injection locations primarily to right-of-ways (road shoulders), with small encroachments into non-wetland forested areas.

Alternative 6 protects human health and the environment through implementation of administrative controls, which will minimize potential risks of exposure for residents, as described in Section 2.7.1. In addition, this alternative returns groundwater outside of the DNAPL source area to beneficial use (reduce COC concentrations to MCLs) through ex-situ and in-situ treatment of the contaminated groundwater and implementation of the LTM program. No unacceptable short-term or cross-media impacts are expected.

2.13 STATUTORY DETERMINATIONS FOR GROUNDWATER INTERIM REMEDIAL ACTION

The selected interim remedial action for groundwater satisfies the statutory requirements of Section 121 of CERCLA, 42 U.S.C. Section 9621. Under CERCLA, remedial actions at sites must achieve protection of human health and the environment, comply with federal and state ARARs (unless a statutory waiver is justified), be cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element are preferred. The following discussion addresses how these statutory requirements and preferences are met by the selected interim remedial action.

2.13.1 Protection of Human Health and the Environment

The selected interim remedial action for groundwater will be protective of human health and the environment. ICs will minimize direct exposure to the contaminated groundwater and unacceptable risk associated with the vapors emanating from the groundwater until concentrations of VOCs have been reduced to MCLs. There are no short-term threats associated with the selected interim remedial action for groundwater that cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the selected interim remedial action. Monitoring and statistical evaluation of trends in concentrations of contaminants requiring remediation will ensure that the selected groundwater interim remedial action is effective and that the plume is not expanding or unexpectedly increasing in concentration. If statistical trends indicate that COC concentrations will not meet MCLs within the anticipated time for remediation (7 years), additional treatment will be proposed for the site.

2.13.2 Compliance with ARARs

Interim actions may be specified under two scenarios: (1) to prevent further plume migration and initiate cleanup while RI/FS and post-RI/FS activities are being completed and (2) to obtain information about the response of the aquifer to remediation measures in order to define final cleanup goals that are practicable for the site. Where there is substantial uncertainty regarding the ability of a remedy to restore groundwater to drinking water quality (i.e., MCLs/MCLGs) or other beneficial uses, which could be reduced by further information obtained during implementation of a remedial action, it will often be appropriate to select an interim remedial action to prevent further plume migration and initiate groundwater restoration. Interim action RODs should not specify final cleanup levels because such goals are beyond the limited scope of the action. These will be addressed by the final remedial action ROD (OSWER Directive 9283.1-03, 10 October 1990).

This alternative calls for the design and implementation of an interim remedial action to protect human health and the environment. The goals of this remedial action are to halt the spread of a contaminant plume, remove contaminant mass, collect data on aquifer and contaminant response to remediation measures and define the area containing DNAPL more accurately. The ultimate goal of remediation will be determined in a final remedial action for this site. This remedial action will be monitored carefully to determine the feasibility of achieving this goal with the method specified in this IROD (See OSWER Directive 9283.1-03, 10 October 1990).

ARARs and TBCs listed in Table B-1 apply only to the substantive requirements for the interim remedial action. CERCLA Section 121(e)(1) states that compliance with administrative requirements (i.e., permits) is not required for any remedial action carried out “entirely onsite” in compliance with CERCLA. The NCP, at 40 CFR Section 300.400(e)(1) explains that “onsite” means the “areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action.” (*See also* CERCLA Section 101(9), 40 CFR Section 300.5, 55 FR 8689, and 53 FR 51406.)

2.13.3 Cost Effectiveness

According to the NCP at 40 CFR Section 300.430(f)(1)(ii)(D), a remedy is cost-effective if its costs are proportional to its overall effectiveness. USAF and USEPA have determined that the selected interim remedial action is cost-effective. Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost effectiveness. The selected interim remedial action was found to be more effective than Alternatives 2 and 3 based primarily on short-term effectiveness. The selected interim remedial action was found to be more effective than Alternatives 4 and 5 based on reduction of mobility because Alternatives 4 and 5 did not provide for gradient control and would result in recontamination of groundwater. The estimated total present worth of the selected interim remedial action for groundwater is $5,845,000, which is significantly less than the present worth of the most expensive alternative (Alternative 5) and less than the present worth cost of the other two alternatives involving active treatment (Alternatives 3 and 4). Thus, the selected interim remedial action is the most effective alternative in addressing the contamination as well as the most cost-effective alternative among the alternatives estimated to achieve cleanup within a reasonable time period.

2.13.4 Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

Although this interim action is not intended to fully address the statutory mandate for permanent solutions and treatment to the maximum extent practicable, this interim action is expected to reduce groundwater contaminant concentrations outside of the DNAPL source area and thus supports that statutory mandate. USAF and USEPA, with MDE concurrence, have determined that the selected interim remedial action (Bioaugmentation and Carbon Substrate Addition with Gradient Control) provides the best balance of trade-offs in terms of the five balancing criteria. The selected interim remedial action affords adequate protection of human health and the environment by treating and monitoring the contaminants in groundwater outside of the DNAPL source area. ICs will be in place until the final remedial action is implemented in accordance with the final ROD. The selected interim remedial action achieves compliance with ARARs and satisfies the long-term effectiveness balancing criterion by reducing residual risks due to groundwater contamination outside of the source area to acceptable levels within 7 years, provided that the DNAPL source is removed, treated, or controlled. The final remedial action for the Brandywine site will address the permanent solution for groundwater contamination at the Brandywine site.

USAF and USEPA also considered the two modifying criteria (i.e., state and community acceptance) in selection of the interim remedial action. No objections to the selected interim remedial action were raised.

The selected interim remedial action satisfies all balancing criteria and modifying criteria and was determined by USAF and USEPA to be the most appropriate solution for the site. The criteria that were most decisive in the selection of the interim remedial action were overall protection of human health and the environment, compliance with ARARs, implementability, and cost-effectiveness.

2.13.5 Preference for Treatment as a Principal Element

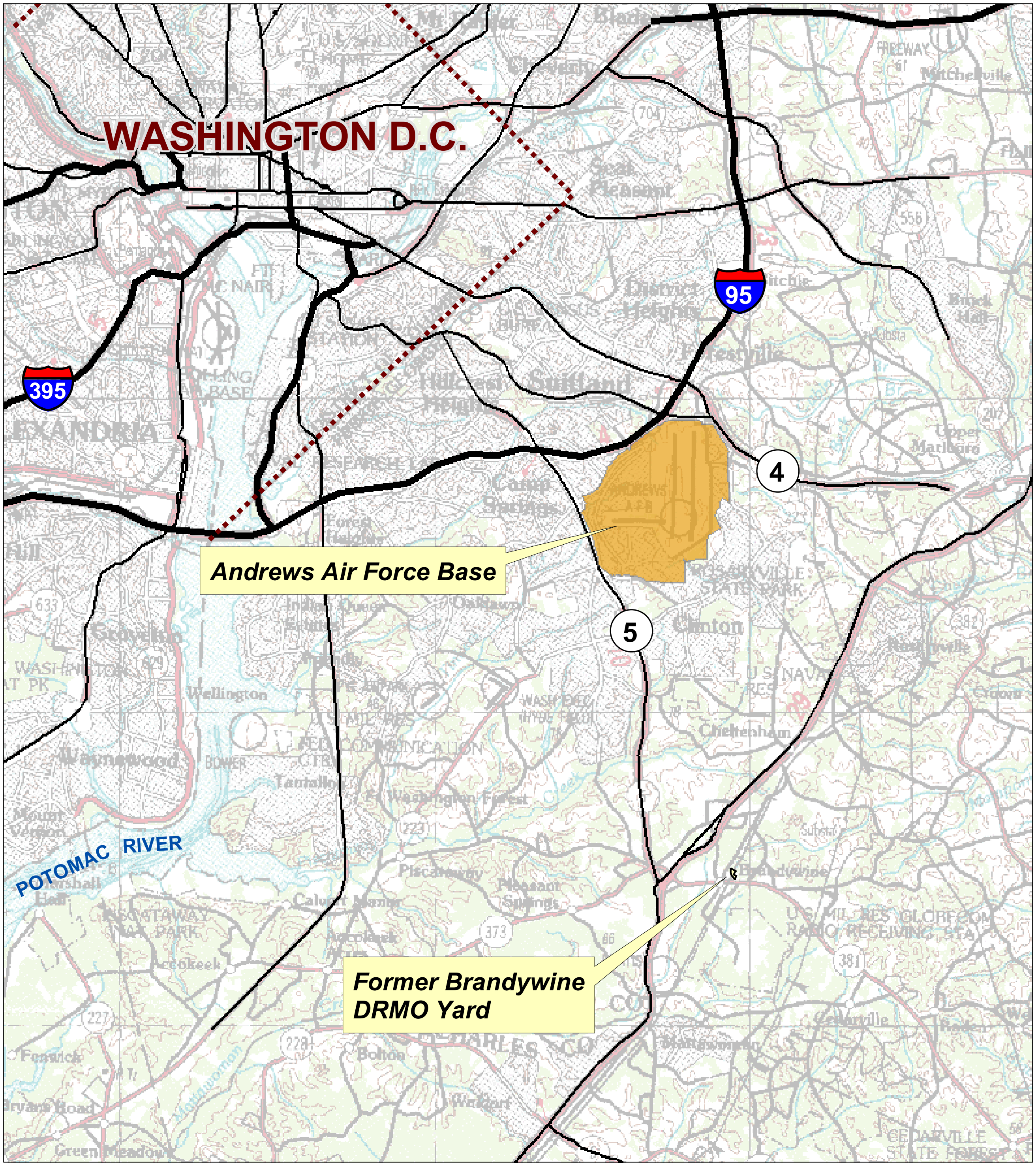
Because this action does not constitute the final remedial action for the site, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this interim remedial action, will be addressed by the final response action. The selected interim remedial action addresses the reduction of toxicity or volume through ex-situ and in-situ treatment of groundwater contaminants verified through long-term monitoring. Groundwater contaminants will biodegrade due to injection of dechlorinating bacteria and carbon substrate into the subsurface. In addition, contaminants will be extracted and treated ex-situ. The interim remedial action also will limit the mobility of groundwater contaminants, including DNAPL, through hydraulic gradient control. Concentrations of COCs will be monitored according to the minimum frequency identified in Section 2.9.6.1. In addition, the selected interim remedial action will provide some treatment of the DNAPL in the source area; the biostimulant (carbon substrate) will enhance dissolution of DNAPL and a reverse gradient will be exerted on the groundwater to sweep the DNAPL zone with the biostimulant, while removing the mobile phase of the DNAPL.

2.13.6 Five-Year Review Requirements

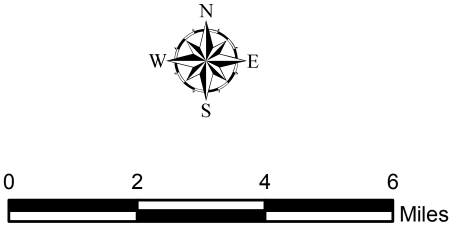
Because the selected interim remedial action for groundwater will result in hazardous substances remaining on site above levels that allow for unlimited use and unrestricted exposure for more than 5 years, a statutory review will be conducted no less than every 5 years after initiation of this interim remedial action until the final remedial action is implemented in accordance with the final ROD in order to ensure that the interim remedial action is, or will be, protective of human health and the environment.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for groundwater treatment at Brandywine, Prince George's County, Maryland, was released for public comment on June 23, 2006. The Proposed Plan identified bioaugmentation and carbon substrate addition with gradient control (Alternative 6) as the preferred alternative for the interim remedial action for groundwater remediation. No objections to the selected interim remedial action were received from the public during the public comment period ending on July 22, 2006. The USAF and USEPA reviewed all verbal comments submitted during the public comment period and determined that no significant changes to the interim remedial action, as originally identified in the Proposed Plan, were necessary or appropriate.



Source: USGS 1°x2° Quadrangle, " Washington D.C." (1989)



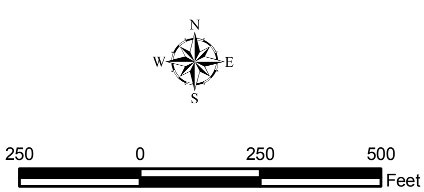
Brandywine Location Map

Site SS-01
Andrews Air Force Base, Maryland

URS

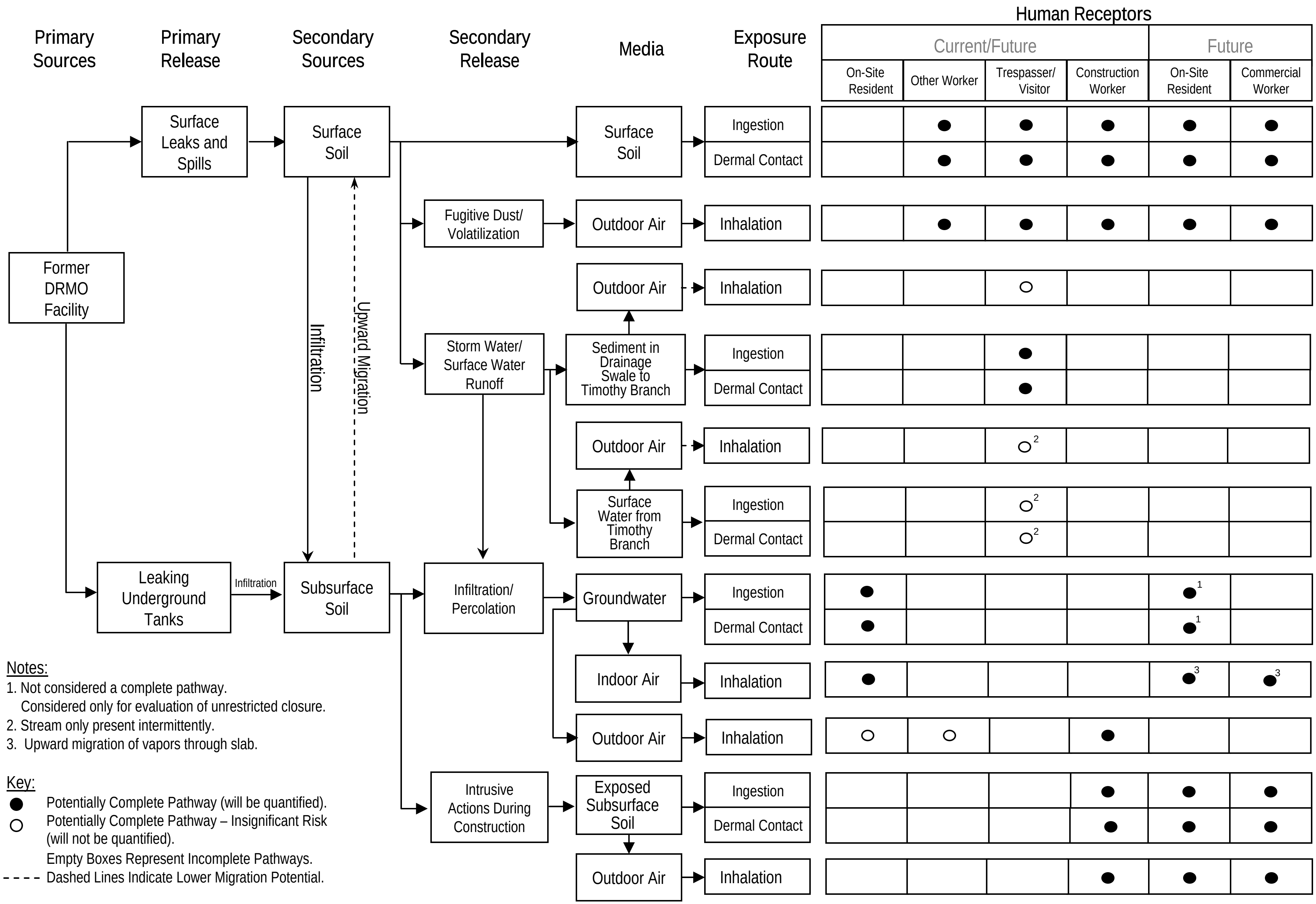
Figure 2-1

Source: USGS Urban Areas color digital aerial photography April 26, 2005



Aerial Photograph of the Brandywine Site
Site SS-01 Andrews Air Force Base, Maryland
URS
Figure 2-2

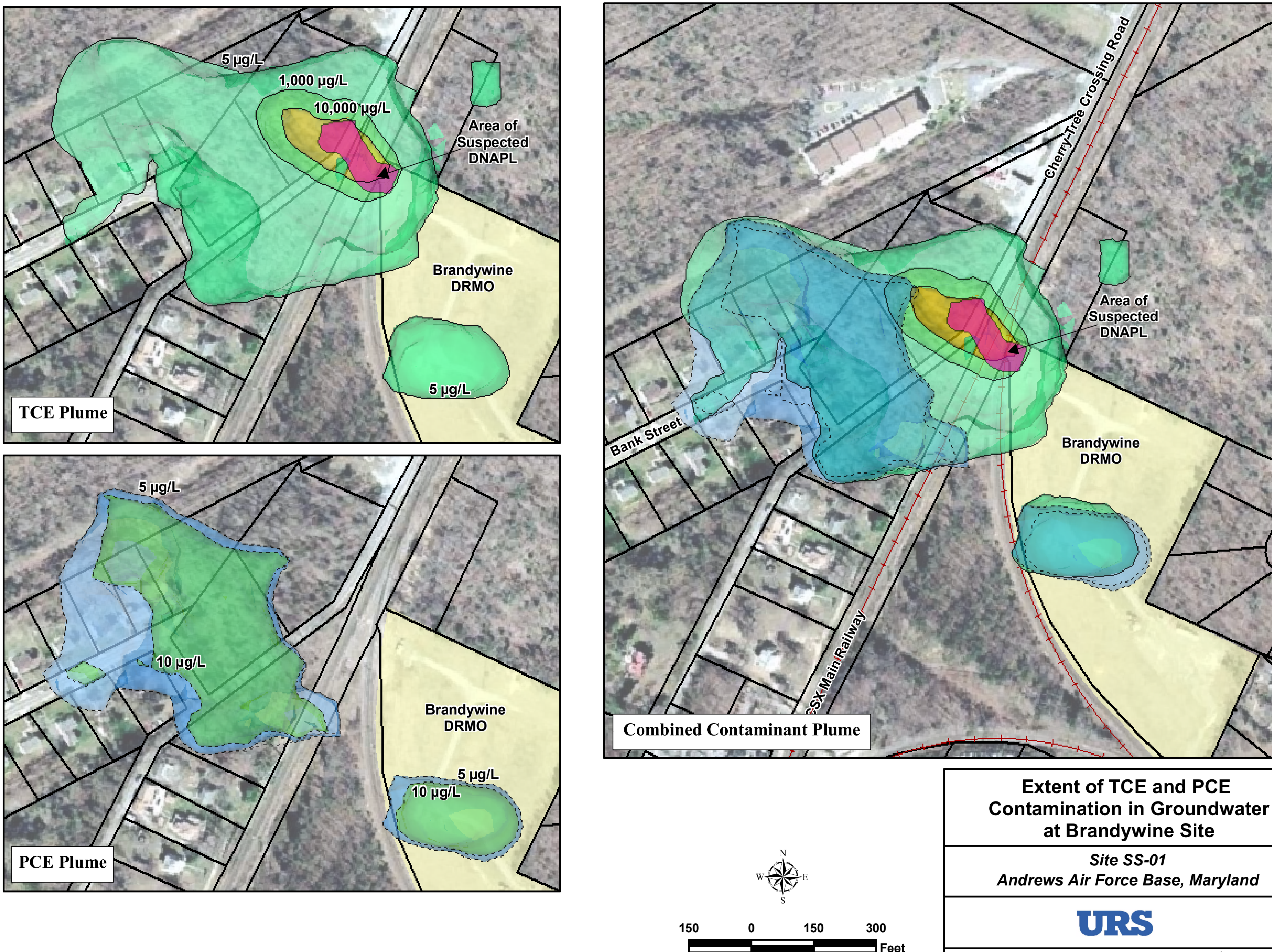
Figure 2-3. Site SS-01 Human Health Conceptual Site Model



Media	Exposure Route	Current/Future: On-Site Resident	Current/Future: Other Worker	Current/Future: Trespasser/ Visitor	Current/Future: Construction Worker	Future: On-Site Resident	Future: Commercial Worker
Surface Soil	Ingestion		●	●	●	●	●
	Dermal Contact		●	●	●	●	●
Outdoor Air	Inhalation		●	●	●	●	●
Outdoor Air	Inhalation			○			
Sediment in Drainage Swale to Timothy Branch	Ingestion			●			
	Dermal Contact			●			
Outdoor Air	Inhalation			○ 2			
Surface Water from Timothy Branch	Ingestion			○ 2			
	Dermal Contact			○ 2			
Groundwater	Ingestion	●				● 1	
	Dermal Contact	●				● 1	
Indoor Air	Inhalation	●				● 3	● 3
Outdoor Air	Inhalation	○	○		●		
Exposed Subsurface Soil	Ingestion				●	●	●
	Dermal Contact				●	●	●
Outdoor Air	Inhalation				●	●	●

Notes:
1. Not considered a complete pathway.
Considered only for evaluation of unrestricted closure.
2. Stream only present intermittently.
3. Upward migration of vapors through slab.

Key:
● Potentially Complete Pathway (will be quantified).
○ Potentially Complete Pathway – Insignificant Risk (will not be quantified).
Empty Boxes Represent Incomplete Pathways.
- - - - Dashed Lines Indicate Lower Migration Potential.

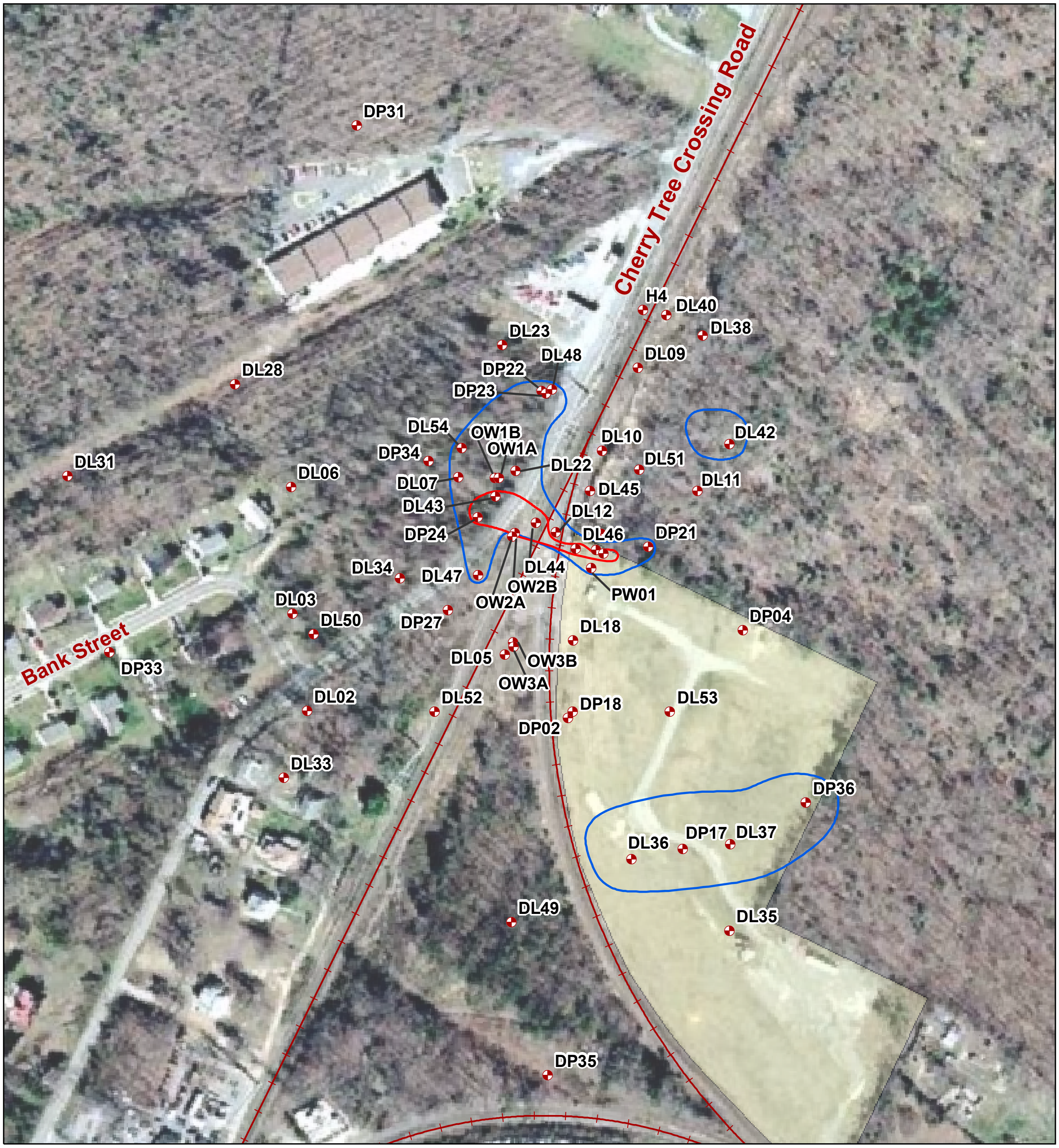


Extent of TCE and PCE Contamination in Groundwater at Brandywine Site

Site SS-01
Andrews Air Force Base, Maryland

URS

Figure 2-4



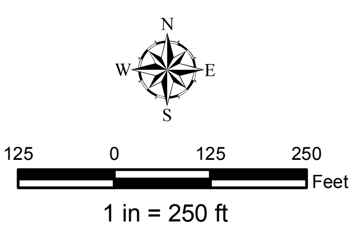
Source: USGS Urban Areas color digital aerial photography April 26, 2005

***cis*-1,2 DCE Contours (µg/L)**
(2002-2003)

70 - 1,000

> 1,000

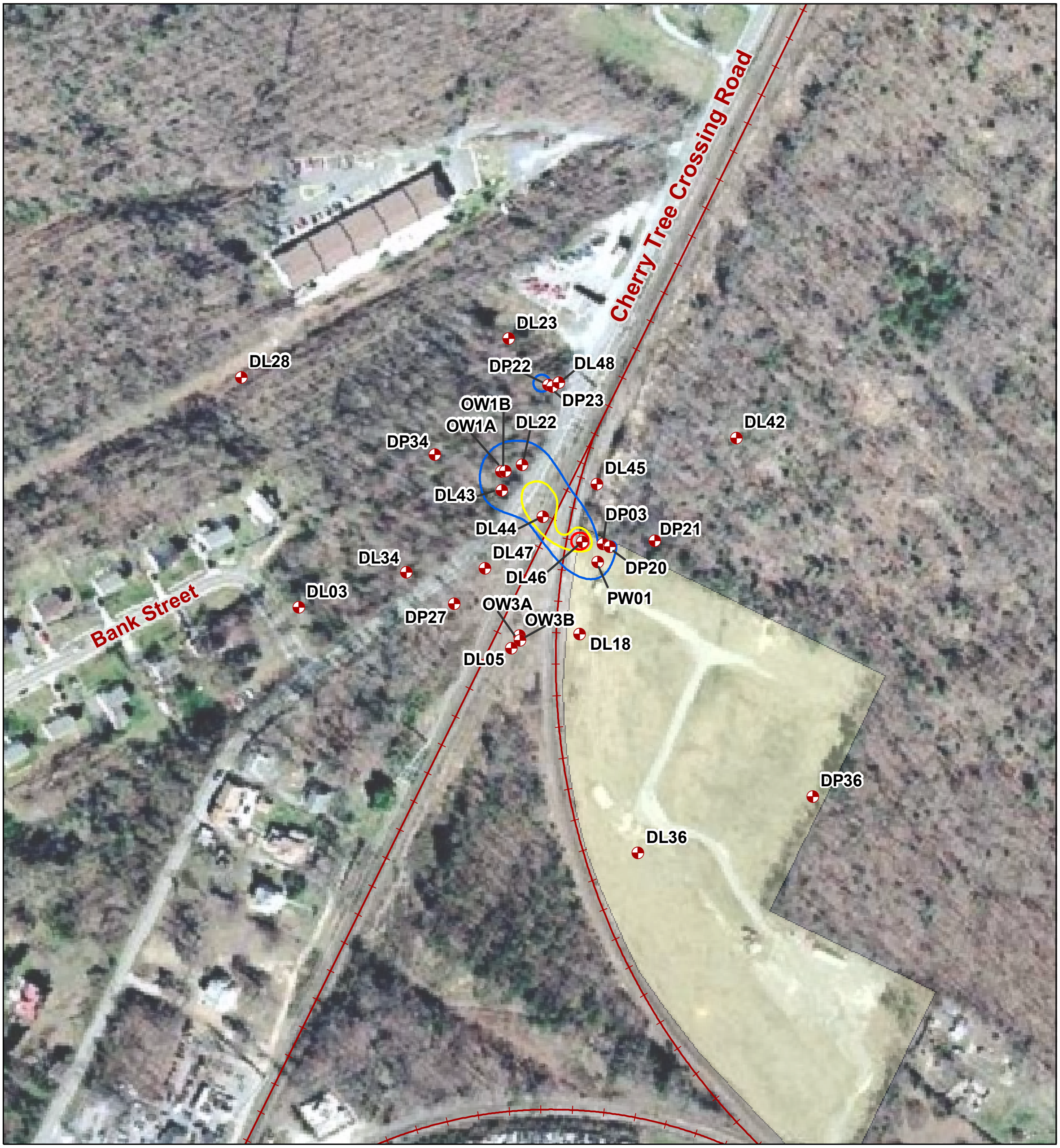
Well used in *cis*-1,2 DCE isoconcentration contouring



Extent of *cis*-1,2 DCE Contamination in Groundwater

Site SS-01
Andrews Air Force Base, Maryland

Figure 2-5



Vinyl Chloride Contours (µg/L)
(2002 and 2003)

2 - 10

10 - 100

> 100

Well used in Vinyl Chloride isoconcentration contouring

N
W E
S

125 0 125 250 Feet

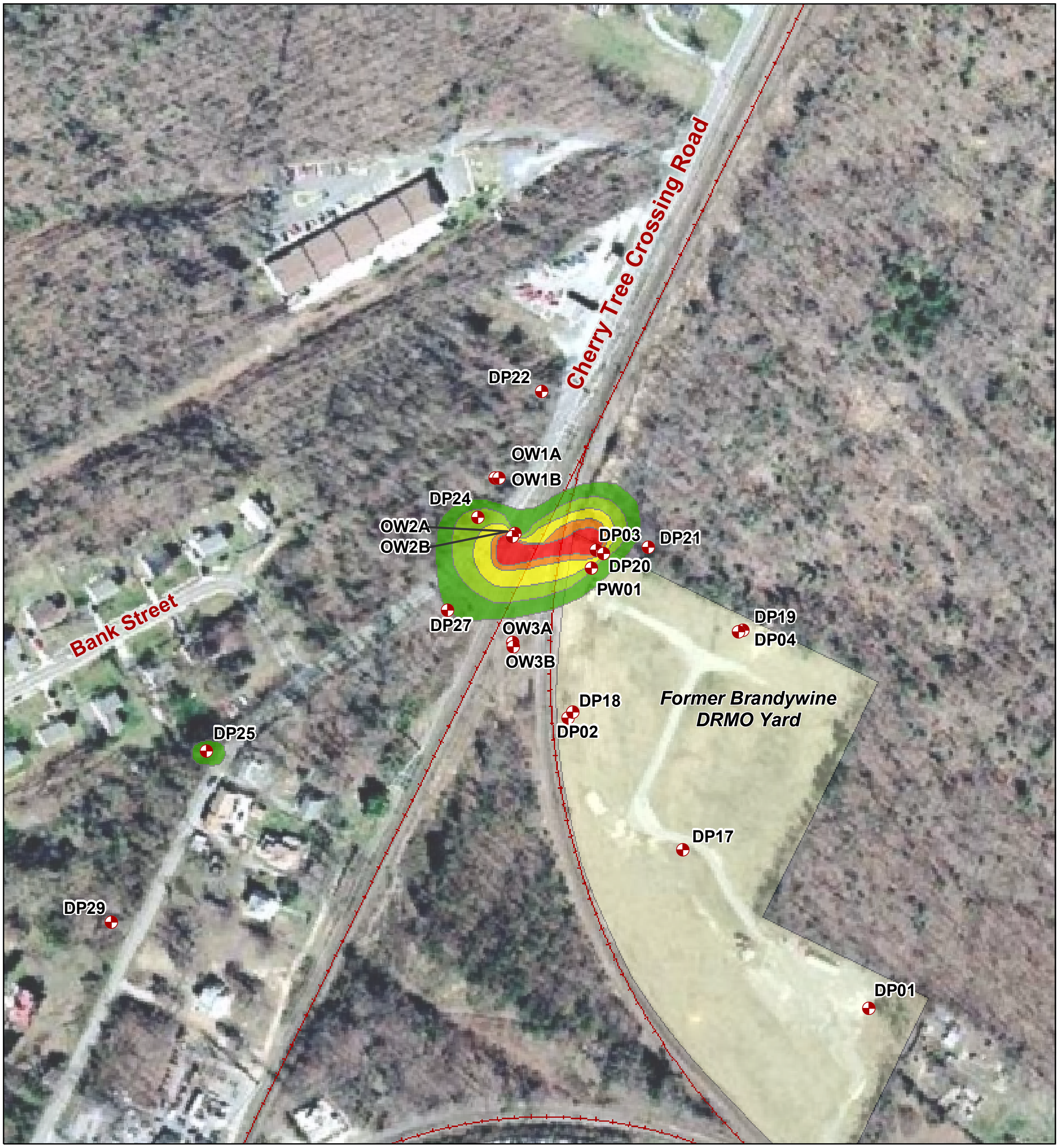
1 in = 250 ft

Extent of Vinyl Chloride Contamination in Groundwater

Site SS-01
Andrews Air Force Base, Maryland

URS

Figure 2-6



Source: USGS Urban Areas color digital aerial photography April 26, 2005

Iron Concentrations (mg/L) (January 2002)

- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10
- >10

Concentrations < 2 mg/L of Iron not shown

Well used in Iron Isoconcentration Contouring

N W E S

125 0 125 250 Feet

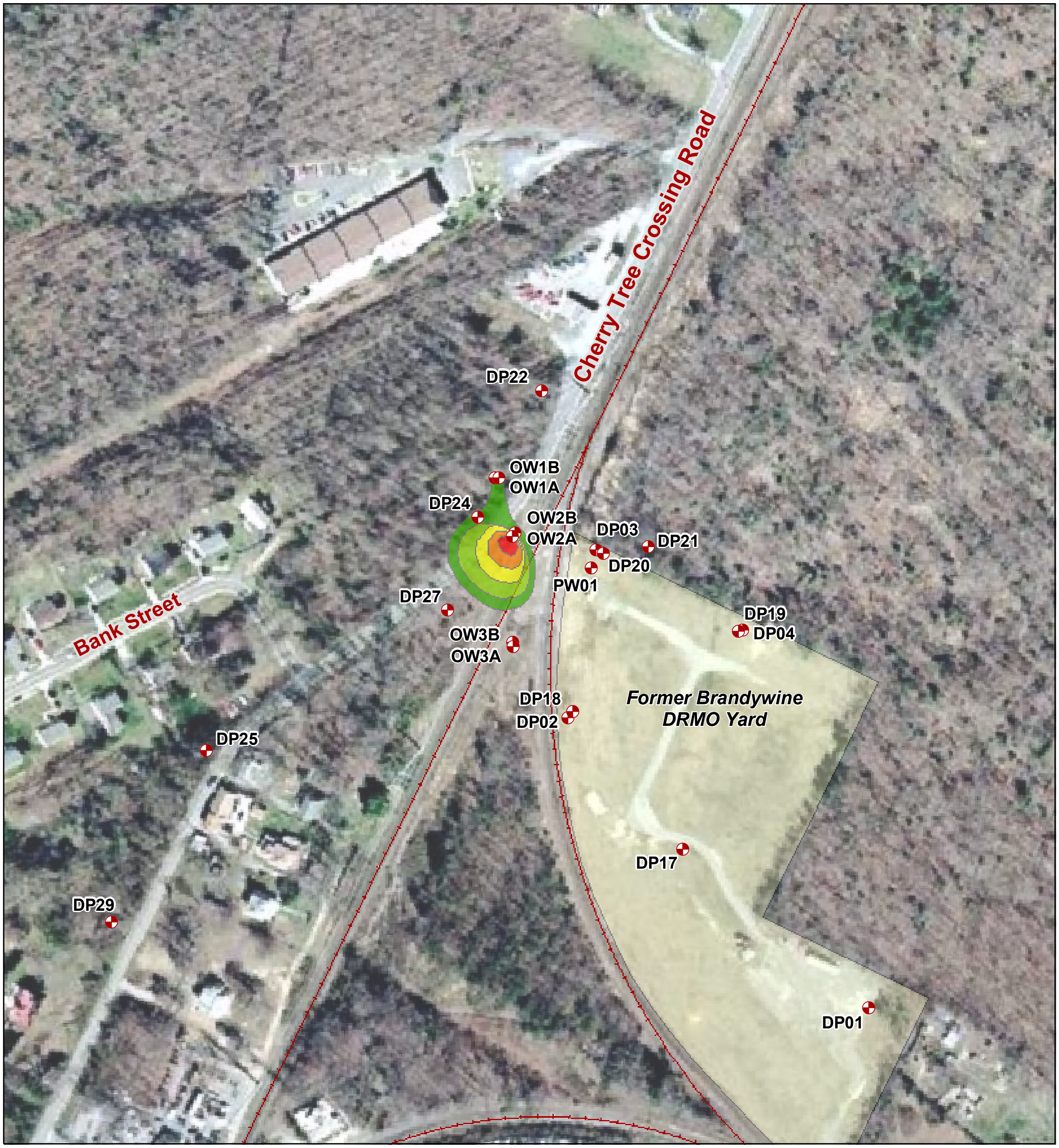
1 in = 250 ft

Iron Concentrations in Groundwater

Site SS-01
Andrews Air Force Base, Maryland

URS

Figure 2-7



Source: USGS Urban Areas color digital aerial photography April 26, 2005

Manganese Concentrations (mg/L) (January 2002)

- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- >1.0

Concentrations < 0.2 mg/L of Manganese not shown

Well used in Manganese Isoconcentration Contouring

N W E S

125 0 125 250 Feet

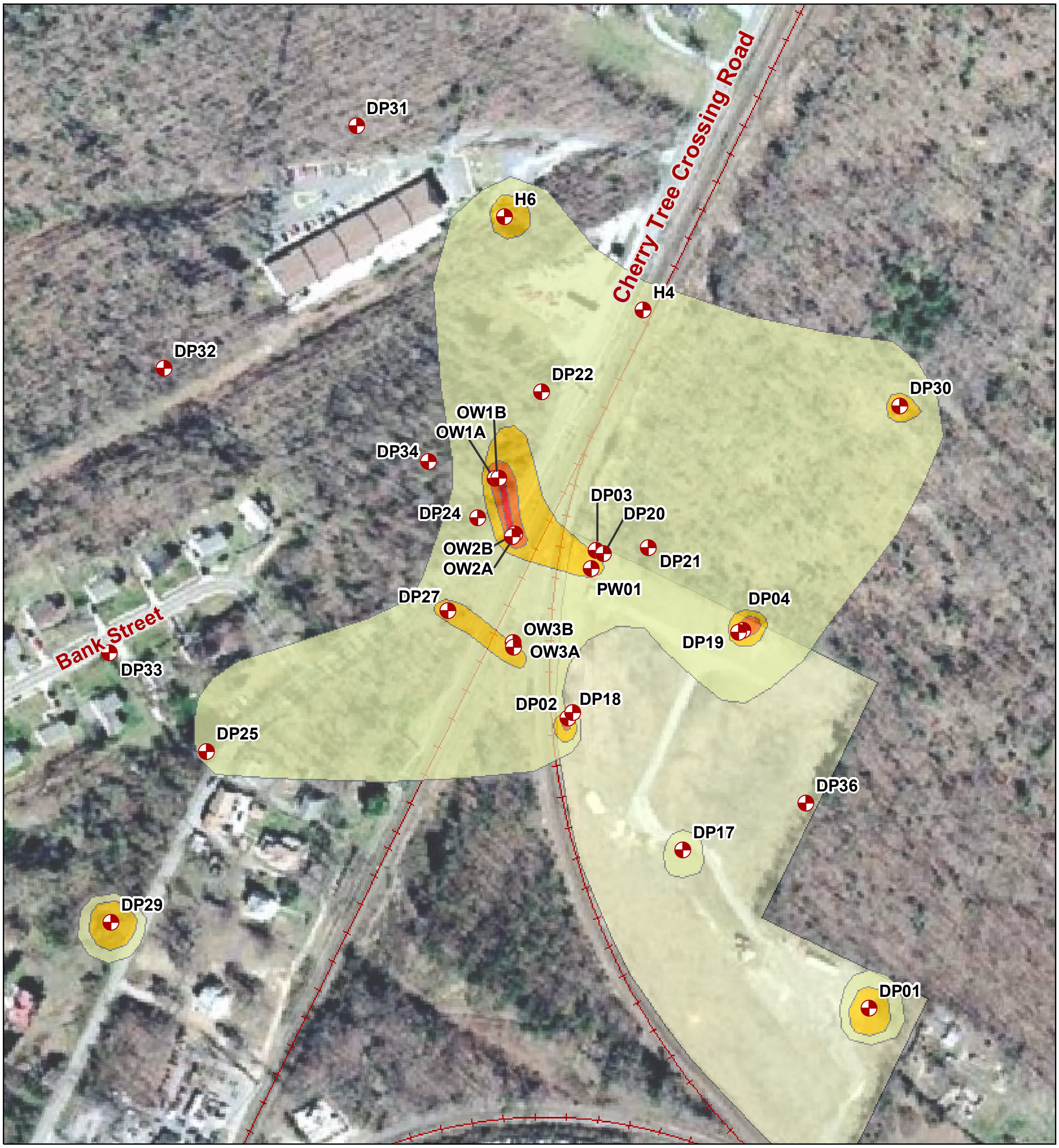
1 in = 250 ft

Manganese Concentrations in Groundwater

Site SS-01
Andrews Air Force Base, Maryland

URS

Figure 2-8



Source: USGS Urban Areas color digital aerial photography April 26, 2005

pH Levels (2002 and 2003)

- 5.5 - 5.0
- 5.0 - 4.5
- 4.5 - 4.0
- < 4.0

pH levels > 5.5 not shown. pH measurement shown on figure is the minimum pH detected at any depth in each well.

Well used in pH level measurements

N W E S

125 0 125 250 Feet

1 in = 250 ft

pH of Groundwater

Site SS-01
Andrews Air Force Base, Maryland

URS

Figure 2-9

Source: USGS Urban Areas color digital aerial photography April 26, 2005

Chloride Concentrations (mg/L) (January 2002)

- 75 - 100
- 100 - 125
- 125 -150
- 200 - 225
- >225

Concentrations < 25 mg/L of Chloride not shown

Well used in Chloride Isoconcentration Contouring

N W E S

125 0 125 250 Feet

1 in = 250 ft

Chloride Concentrations in Groundwater

Site SS-01
Andrews Air Force Base, Maryland

URS

Figure 2-10

Source: USGS Urban Areas color digital aerial photography April 26, 2005

2.5 Naphthalene Concentration (µg/L) (January 2002)

1.8 2-Methylnaphthalene Concentration (µg/L) (January 2002)

Sample location with detectable concentrations of Naphthalene or 2-Methylnaphthalene. All other sampled locations (33 total) non-detect.

10,000 µg/L contour for TCE

N W E S

125 0 125 250 Feet

1 in = 250 ft

Extent of Naphthalene and 2-Methylnaphthalene in Groundwater

Site SS-01
Andrews Air Force Base, Maryland

URS

Figure 2-11

USGS Urban Areas color digital aerial photography April 26, 2005

500 feet from plume
(zone where limits may apply to groundwater extraction)

N
W E
S

250 0 250 500
Feet

Groundwater Institutional Controls

Site SS-01
Andrews Air Force Base, Maryland

URS

Figure 2-12

Figure 2-13

Detailed NCP Criteria

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

- How Alternatives Provide Human Health and Environmental Protection

COMPLIANCE WITH ARARs

- Compliance With Chemical-Specific ARARs
- Compliance With Action-Specific ARARs
- Compliance With Location-Specific ARARs
- Compliance With Other Criteria, Advisories, and Guidance (TBC Guidance)

LONG-TERM EFFECTIVENESS AND PERMANENCE

- Magnitude of Residual Risk
- Adequacy and Reliability of Controls

REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT

- Treatment Process Used and Materials Treated
- Amount of Hazardous Materials Destroyed or Treated
- Degree of Expected Reductions in Toxicity, Mobility, and Volume
- Degree to Which Treatment is Irreversible
- Type and Quantity of Residuals Remaining After Treatment

SHORT-TERM EFFECTIVENESS

- Protection of Community During Remedial Construction
- Protection of Workers During Remedial Construction
- Environmental Impacts
- Time Until Remedial Action Objectives Are Achieved

IMPLEMENTABILITY

- Ability to Construct and Operate the Technology
- Reliability of the Technology
- Ease of Undertaking Additional Remedial Action, if Necessary
- Ability to Monitor Effectiveness of Remedy
- Ability to Obtain Approvals From Other Agencies
- Coordination With Other Agencies
- Availability of Off-site Treatment, Storage, and Disposal Services and Capacity
- Availability of Necessary Equipment, Materials, and Personnel
- Availability of Prospective Technologies

COST

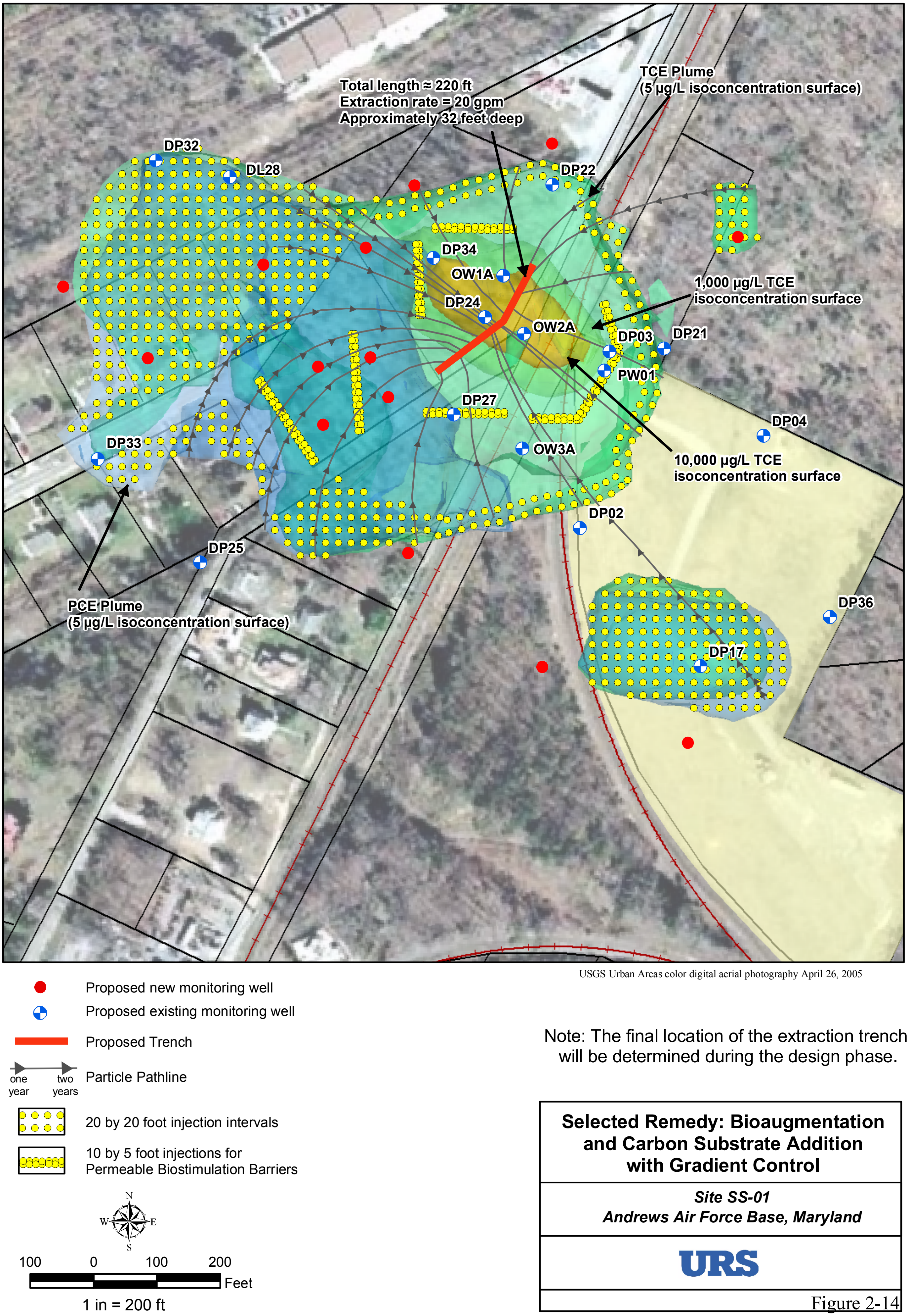
- Capital Costs
- Operating and Maintenance Costs
- Present Worth Cost

STATE (1) ACCEPTANCE

COMMUNITY (1) ACCEPTANCE

[1] These criteria are assessed following comment on the FFS and the Proposed Plan.

Source: Figure taken from Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, USEPA, October 1988.



Note: The final location of the extraction trench will be determined during the design phase.

Selected Remedy: Bioaugmentation and Carbon Substrate Addition with Gradient Control

Site SS-01
Andrews Air Force Base, Maryland

URS

Figure 2-14

3.0 RESPONSIVENESS SUMMARY

The Responsiveness Summary provides a summary of the public's comments, concerns, and questions about the proposed actions for Brandywine groundwater interim remedial action as well as the soil removal action. Also included is the USAF's responses to these concerns.

The public comment period for the proposed interim remedial action for Brandywine groundwater, and proposed soil removal action began on June 23, 2006. A public meeting was held on June 29, 2006, to describe the proposed actions and to solicit and accept either written comments or oral comments. The Notice of the Public Meeting was published in the *Prince George's County Gazette* on June 22 and 29, 2006 and in the *Washington Post-Prince George's "Extra" weekly edition* on June 22, 2006. The notice was also placed in the Andrews AFB newspaper, *The Capitol Flyer*. A copy of the Public Notice and the transcript from the public meeting are presented in Appendices C and D, respectively.

3.1 OVERVIEW

At the time of the public comment period, USAF had endorsed a groundwater treatment alternative (Alternative 6) to remove contaminants from groundwater at the Brandywine site. The USAF also endorsed a preferred soil removal action to remove primarily PCBs from the soil at the former DRMO and a wetland forest located very close to the DRMO. The preferred groundwater treatment alternative involved bioaugmentation and carbon substrate addition with gradient control and groundwater monitoring and ICs, with further treatment if remediation goals are not met, to address COCs in groundwater at the Brandywine site. Soil removal would be accomplished through excavation and disposal of PCB-contaminated soil.

Other than questions voiced during the public meeting relating to the extent of PCB contamination that will be removed, transport of contaminated soil through the community and future use of the property, no other public comments were received during the public comment period. No objections to the selected interim remedial action were made by the public during the public meeting.

3.2 BACKGROUND ON COMMUNITY INVOLVEMENT

The USAF has maintained a public involvement and information program for the ERP since 1990. The Administrative Record is the collection of documents that were relied upon to make remediation decisions. The Administrative Record also includes items that record the legally required public participation in the remediation process. The Administrative Record is a growing archive, and is located at the Environmental Flight, Building 1419, on Andrews AFB.

The publicly available copy of the Administrative Record is called the Information Repository. The Information Repository is contained on a set of CD-ROMs that consist of scanned images and fact sheets. The Information Repository contains Remedial Investigation/Focused Feasibility Study reports, Engineering Evaluation/Cost Analysis report, decision documents, remedial design documents, and news releases. The Information Repository will be updated on an as needed-basis to reflect additions to the Administrative Record.

To review the Information Repository, visit:

Prince George's County Memorial Library-Surratts-Clinton Branch
9400 Piscataway Road
Clinton, MD 20735
Phone (301) 868-9200

Andrews AFB does not have a Restoration Advisory Board (RAB) at this time. Approximately every two years Andrews AFB solicits the local community for interest in creating a RAB. The most recent survey indicated a desire to be provided updates to the program via a newsletter. A periodic newsletter is in the draft stage and will be direct mailed to the community. Andrews AFB has a website, http://public.andrews.amc.af.mil, which the public can access. Notices of public meetings are posted in local newspapers to encourage public involvement.

Andrews AFB community relations activities for the final selected interim remedial action for Brandywine groundwater and removal of the soil included the following:

- The documents concerning the investigation and analysis of Brandywine groundwater and soil (i.e., Remedial Investigation, Focused Feasibility Study, and Engineering Evaluation/Cost Analysis Reports), as well as copies of the Proposed Plan, were placed in the Information Repository.

- Newspaper announcements on the availability of documents and the public meeting and comment period were published in the *Prince George's County Gazette* on June 22 and 29, 2006 and in the *Washington Post-Prince George's "Extra" weekly edition* on June 22, 2006. The notice was also placed in the Andrews AFB newspaper, *The Capitol Flyer*.

- The Air Force established a 30-day public comment period for this Proposed Plan and Engineering Evaluation/Cost Analysis starting June 23, 2006 and ending July 22, 2006.

- A public meeting was held on June 29, 2006 to present the Proposed Plan for groundwater treatment in accordance with the Focused Feasibility Study and the proposed alternative to remove PCB-contaminated soil in accordance with the Engineering Evaluation/Cost Analysis. The purpose of the meeting was to solicit comments and provide responses to the interested public. Approximately 20 people were present at the public meeting, of which six were residence of the community.

3.3 SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND AIR FORCE RESPONSES

No significant concerns were received during the public meeting on June 29, 2006. Questions at the public meeting were received regarding the future use of the DRMO property, whether trucks would carry contaminated soil through the community or spillage could occur during the cleanup, and the limitations on drilling of new wells over the plume.

Decontamination procedures (of trucks and other equipment) were described and the prohibition of shallow potable wells in the area of the plume was discussed and the explanations were accepted by the public. The future use of the DRMO property would be limited to commercial usage; however, the timing of any transfer from the government is several years in the future. No written comments were received during the 30-day public comment period ending July 22, 2006.

The USAF and the USEPA continue to believe that bioaugmentation and substrate addition with gradient control adequately and appropriately addresses groundwater contamination at Brandywine in accordance with CERCLA Section 121 and the NCP. The USAF and the USEPA also continue to believe that removal of PCB contaminated soil from the site is sufficiently protective of the public health and environment.

4.0 REFERENCES

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Appendix A
Maryland Department of the Environment
Concurrence Letter

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101

September 20, 2006

Mr. Brian Dolan
89 CES/CEVR
1419 Menoher Drive
Andrews Air Force Base
MD 20762

RE: Interim Record of Decision, Former Brandywine Defense Reutilization and Marketing Office (DRMO), Andrews Air Force Base, Maryland (September 2006)

Dear Mr. Dolan:

The Federal Facilities Division (FFD) of Maryland Department of the Environment's (MDE) Hazardous Waste Program has reviewed the above referenced document. This Interim Record of Decision (IROD) documents the joint concurrence of the Environmental Protection Agency (EPA) and the Air Force on the selected remedial action to treat contaminated portions of the shallow aquifer with a combination of in-situ treatment and groundwater extraction. This remedial action includes injection of a carbon substrate and naturally occurring microbes into the aquifer to accelerate the natural biodegradation of volatile organic contaminants in the groundwater. Groundwater extraction will be used to control the direction of groundwater flow and prevent the expansion of the contaminant plume during treatment.

A public meeting was held on June 29, 2006 to present the proposed interim remedial action contained in this IROD. No written or verbal comments were received during the public meeting or during the 30-day public comment period. The FFD supports the Air Force's interim remedy selection for treatment of contaminated groundwater in the vicinity of the former Brandywine DRMO. If you have any questions, please contact me at (410) 537-3398.

Sincerely,

Rick Grills

Rick Grills
Remedial Project Manager
Federal Facilities Division

RG:mh
cc: Mr. Andrew Sochanski
Mr. Manfred Reichwein
Mr. Horacio Tablada
Mr. Harold L. Dye, Jr.

Appendix B
Summary of Federal and State ARARs

Table B-1
ARARs and TBCs
for Brandywine Groundwater Alternatives†

Federal or State Statute, Regulation or Guidance	Summary of Requirement	Type of ARAR	ARAR Category
Hazardous Waste			
Maryland Hazardous Waste Regulations COMAR 26.13.05.02 thru .05 and .09	General Facility Standards provide for security at the site, periodic inspections, management of incompatible wastes, contingency planning, monitoring and corrective action for releases, proper containerization of waste, etc.	RA	Action
Maryland Hazardous Waste Regulations COMAR 26.13.03.01 thru .06	Standard applicable to generators of hazardous waste, including satellite accumulation procedures and storage time allowed before disposal off-site is required.	RA	
Water			
Maryland Erosion and Sediment Control Regulations, COMAR 26.17.01	Provides for the conservation and protection of the water resources of the state by requiring that any land-clearing, grading, other earth disturbances greater than 5,000 square feet require an erosion and sediment control plan.	A	Action
Maryland Stormwater Management Regulations, COMAR 26.17.02	Provides for the management of stormwater runoff to reduce impacts on land and water resources; development and construction actions must have an approved plan.	RA	Action
Maryland Nontidal Wetlands Regulations, COMAR 26.23.01 and 26.23.04	Parallels federal CWA Section 404 with 3 basic differences regarding isolated wetlands, alteration of vegetation and hydrology, and use of 25-feet and 100-feet buffers around wetland areas; includes a no net loss of wetlands provision.	A	Action
Maryland Water Pollution Regulations COMAR 26.08.02.03 and 26.08.03.01	State general water quality criteria restricting water pollution sources, and effluent limitations on quantity and polluting substances	A	Action
Air			
Maryland Air Quality Regulations, COMAR 26.11.04 and .06	Provides restrictions for air emissions from construction activities, vents, and treatment technologies such as air strippers. Also includes nuisance and odor control.	A	Action
Miscellaneous			
Maryland State Office of Planning, Areas of Critical Concern, Article 88C (and the Planning Act Article 66B)	Identifies areas of special concern throughout the state, specifically calls out wetlands.	RA	Location
Statement of Procedures on Floodplain Management and Wetlands Protection, 40 CFR Part 6 Appendix A	These regulations provide for the administration of Executive Orders 11988 *Floodplain Management* and 11990 *Protection of Wetlands.*	RA	Location
Executive Order 11990, Protection of Wetlands	Requires federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.	TBC	Location
Maryland Nontidal Wetlands Regulations, COMAR 26.23.01 and .04	Parallels federal CWA Section 404 with 3 basic differences regarding isolated wetlands, alteration of vegetation and hydrology, and use of 25-feet and 100-feet buffers around wetland areas; includes a no net loss of wetlands provision. Provides that certain regulated activities may not be conducted in a nontidal wetland, or within a buffer or an expanded buffer unless the state has issued a permit.	RA	Location

Table B-1
ARARs and TBCs
for Brandywine Groundwater Alternatives†

Federal or State Statute, Regulation or Guidance	Summary of Requirement	Type of ARAR	ARAR Category
Maryland's Wetland Restoration Initiative	Commits to increasing the total area of wetlands in the state by 60,000 acres and strengthens the "no net loss" rules.	TBC	Location
Fish and Wildlife Coordination Act, Public Law 89-72	Requires that actions that will impact fish or wildlife must include efforts to protect these affected resources.	RA	Action
Miscellaneous (cont.)			
Executive Order 13148 Greening the Government through Leadership in Environmental Management , Part 6–Landscaping Management Practices, Section 601(a)	Requires incorporation of federal guidance on landscaping federal grounds into landscaping procedures for all federal agencies.	RA	Action
Maryland Forest Conservation Act, Natural Resources Article 5-164-1612	Provides for the replacement of trees when actions result in harvesting that is extensive enough to meet specified criteria.	RA	Action
Maryland Occupational, Industrial, and Residential Hazards Regulations, COMAR 26.02.03	Provides limits on the maximum allowable levels of noise at the site boundaries during site remediation work to protect the health, general welfare, and property of the people of the state.	A	Action
Maryland Water Supply, Sewage Disposal, and Solid Waste Regulations, COMAR 26.04.04 and .07	Provides specifications for well construction and abandonment. Provides for proper closure and post closure monitoring and maintenance of landfills.	RA	Action
Maryland Board of Well Drillers Regulations, COMAR 26.05.01	Provides licensing requirements for persons drilling and installing wells in the state. Assures that monitoring wells are installed by qualified well drillers.	A	Action
Maryland Waterworks and Waste Systems Operator Regulations, COMAR 26.06.01	Provides certification requirements for persons operating facilities used to collect, store, pump, treat, or discharge any liquid or waterborne waste.	RA	Action

† ARARs and TBCs listed in this table apply only to the interim remedial action. A new list of ARARs and TBCs will be formulated for the final ROD for the Brandywine site.
Action-specific ARARs are determined according to the specific technologies or activities taking place under an alternative.
Chemical-specific ARARs are not appropriate for interim ROD (OSWER Directive 9283.1-03, 10 October 1990).
Location-specific ARARs are determined according to site-related characteristics such as geology, floodplains, wetlands, sensitive ecosystems and habitats, and historic places.

A = Applicable Requirement
ARAR = applicable or relevant and appropriate requirements
AWQC = Ambient Water Quality Criteria
CFR = Code of Federal Regulations
COC = chemicals of concern
COMAR 26 = Code of Maryland Regulations Title 26, Department of the Environment (January 7, 2005)
NPDES = National Pollutant Discharge Elimination System
RA = Relevant and Appropriate Requirement
RBC = risk-based concentration
TBC = To Be Considered
USEPA = United States Environmental Protection Agency

Appendix C
Public Comment Newspaper Notice

The United States Air Force Requests Public Comment on the Proposed Plan and the Engineering Evaluation/Cost Analysis (EE/CA) for the Former DRMO Yard at Brandywine, Maryland

The U.S. Air Force (USAF) and the U.S. Environmental Protection Agency (USEPA) have issued a **Proposed Plan** for addressing shallow groundwater contamination and an **EE/CA** for addressing polychlorinated biphenyls (PCBs) contamination in the soil in the vicinity of the former Defense Reutilization and Marketing Office (DRMO) yard in Brandywine, Prince George's County, Maryland. You are invited to review the Proposed Plan, EE/CA, and their supporting documents, and submit your comments on the plan during the 30-day public comment period, **June 23 – July 22, 2006**.

SITE DESCRIPTION: The former DRMO yard is located eight miles south-southeast of Andrews Air Force Base in Brandywine, MD. The Brandywine DRMO functioned as a storage area for the Navy beginning in 1943 and handled excess government property through 1987. Past activities at the site resulted in releases of volatile organic compounds (VOCs) into the groundwater and releases of PCBs into the surface soil at the former DRMO yard and its vicinity. Results of site investigations suggest that the VOCs in the groundwater at Brandywine consist primarily of trichloroethene (TCE), a cleaning solvent. During 1994, PCB contaminated soil was excavated from the DRMO yard. In September 1996, a system to extract and treat contaminated groundwater was constructed at the northwest corner of the former DRMO. The existing system has helped improve groundwater quality in the immediate vicinity of the former DRMO, but a more comprehensive solution is required.

PROPOSED PLAN: The USAF and USEPA propose to use the injection of a carbon substrate and naturally-occurring microbes into the subsurface to accelerate the natural breakdown of the VOCs in the groundwater, as well as the installation of a new groundwater extraction and treatment system at the site. Institutional controls will be maintained at the site to prevent exposure to contaminated groundwater while remediation continues.

EE/CA: The USAF and USEPA propose to use an ecologically balanced approach to clean up soil contaminated with PCBs, metals and dieldrin through excavation. Affected areas will be restored to natural conditions through grading and revegetation.

FOR REVIEW: The comprehensive cleanup strategy presented within the Proposed Plan, EE/CA, and all supporting documents are available for review at **Prince George's County Library, Surratts-Clinton Branch**, 9400 Piscataway Road, Clinton, Maryland (301-868-9200).

TO LEARN MORE: The USAF and USEPA invite you to attend an information session on the Proposed Plan. This will be held on **Thursday, June 29, 2006, 5:30-7:30 p.m. at the Brandywine Fire Department, 14201 Brandywine Road, Brandywine, Maryland.** Informal poster session begins 5:30, proposed plan presentation 6:15-7:00, question and answers period from 7:00-7:30. The USAF will present and explain the Proposed Plan and will receive oral and written comments at the meeting.

TO SUBMIT COMMENTS: Written comments may be submitted by mail, email, or fax to:

89th Airlift Wing Public Affairs Office (89AW/PA)
1535 Command Drive
Andrews AFB, MD 20762-7002
Fax: (301) 981-4588
Email: 89pa.comrel@andrews.af.mil

Appendix D
Transcript of Open Discussion from the Public Information Session for the Proposed Plan, June 29, 2006

PUBLIC MEETING FOR }
FORMER BRANDYWINE DRMO }
ANDREWS AIR FORCE BASE, MD }
JUNE 29, 2006 }

The Hearing held at the Brandywine Fire Department, Brandywine Road, in Brandywine, Maryland, Taken on June 29th, 2006, scheduled to commence at 6:00 p.m., before Christine Fox, Notary Public.

Reported by: Christine Fox, CSR

PRESENT:

BRIAN DOLAN
Chief Environmental Restoration
316th Airlift Wing
Andrews Air Force Base
316 CES/CEVR

1419 Menoher Drive
Andrews AFB MD 20762-4803
(301) 981.7121 (Tel)
858.7121 (DSN)
(301) 981.7125
Brian.dolan@andrews.af.mil

ALSO PRESENT:

MANFRED REICHWEIN
ANDREW SOCHANSKI
RICK GRILLS
JOHN FRANZ
RON BICKERSTAFF
LT. COL. CALVIN WILLIAMS

P R O C E E D I N G S,

MR. DOLAN: Thank you all for coming tonight.

My name is Brian Dolan. I'm chief of the Environmental Restoration Program at Andrews Air Force Base. I've been there for about five years. I work with my staff to investigate and address releases of chemicals into the environment.

I'm glad you're here tonight. We can answer some questions. Hopefully, we'll get some other folks to trickle in as we move on, and sort of mark this step towards getting a remedy installed at Brandywine.

Before I got too far in, I wanted to welcome my commander, Lieutenant Colonel Calvin Williams, up here for some just brief comments.

LT. COL. WILLIAMS: Welcome. How's everybody

Doing?

SPEAKER: Very good.

LT. COL. WILLIAMS: I never stand behind a podium, so I don't know how long I'll be here, but this will be short because I've only had one meal today and I normally have four.

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What I really want to do is to kind of introduce our team to you and kind of give you an idea what our mission is really all about.

The guy that I go to quite often, I am the -- I'm the base civil engineer at Andrews Air Force Base. I'm also the base fire marshal at Andrews Air Force Base.

I stand today on behalf of my wing commander, Colonel Paul Hackerly, to kind of share a few words with you and kind of give you a mission, mission brief or mission overview.

Mr. John Franz is my chief of environmental management. He is really the mainstay. He is the cornerstone. He's the guy that I go to, because obviously I can't -- I can't always be there to address those things that we think are most critical when you look at the -- our overall focus in our mission statement.

So from an environmental perspective, Mr. John Franz is our go-to.

From a restoration perspective, you've already

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heard from Mr. Brian Dolan. He is the guy that we -- we look to, to be the more technical guy, who can get into the weeds and know really what's going on with our restoration program.

Mr. Mike Rooney, our restoration manager -- Mike, where are you? Right there. He's the guy that -- we in the military -- you know, we're in the mode of doing more with less. And sometimes that doesn't always work, and so we have to rely on a team of individuals and that team does consist of contractors. So we're glad to have him on our team. Thanks a lot.

Obviously we have partners. And those partners, first and foremost, Mr. Sochanski from Region III, sitting in the back, thank you for being here. It is always a pleasure to see you.

Today, when I was coming and I was looking on all the names, it's interesting because I see a lot of people all the time. I said okay, I need to create some data points, and so -- but he moved on me. But that's okay.

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Indeed, where is Butch? Butch is here. The name says Harold Dye, but obviously he goes by Butch. We're glad to have you here, as well as Mr. Rick Grills, who's sitting next to him. They're the Prince George's County Health Department folks.

We've got Mr. Paul Meijer -- he is sitting back here -- and Mr. Manfred Reichwein, who is right here. And we're in -- Ms. Evelyn Hoban, who has a four-year-old, like me. Thank you for coming.

And we have two contractors with us, URS Corporation, they provide a mainstay with our contractors, our support. And that's Mr. Colonna, and also Miss Erika Hintz. Where's Erika? Right there.

Okay. Next slide.

Now that we've got all the difficult stuff out of the way, we'll talk about the 316 mission. I won't read it to you, but I'll kind of give you three data points to focus on.

One is emergency response, and how to do we that? We have rotary wing aircraft that we utilize in order to do that for the national capital region.

The other thing is we provide combat forces to the AOR, in support of our mission that is going on today. We are deploying folks daily in support of that mission.

Last, but not least, and there's actually two part to that. One is the fact that we provide a very secure installation for our senior leaders, both civilian and military. We provide a fly-in, fly-out, capability unlike most air force bases. And we provide that infrastructure that's needed in order to -- for us to accomplish the mission with our blue and white aircraft.

In particular, though, the reason why we're here tonight, it has to do with our environmental. We believe in being good stewards. We believe in being -- and we believe in taking the lead. And tonight that is what we're doing and that is taking the lead.

Of the objectives, there's three there that you'll see. Natural resources, probably the best way to explain that is like-facilities.

We believe that it -- that air, water, and land

needs to be used as well as maintained.

So we're -- we're in the business of maintaining the air, land, and the -- the air, land, and water in such a way that we are ensured that, whatever we do, we protect it, we take care of it, and we make sure that it's -- can be reused.

From the perspective of compliance through pollution prevention, that's very simple.

Obviously, the more prevention you put forth, the less you'll find yourself out of compliance. It's very near and dear and very important to us.

The last one, it's really -- the primary focus of why we're here, and that is to be proactive with our past practices from a cleanup perspective. And with that, Mr. Brian Dolan is going to come up and take the lead and kind of talk a little bit more in the area of restoration.

Thank you for your time.

MR. DOLAN: So, as he said, you know, my group is working on restoring the land and water from activities that were going on.

When Andrews began in the '40s, there were no environmental laws back then, so aircraft maintenance, fire training, landfill activities, all those sorts of the things that happened in industrial facilities going on at that time, people were unaware of what those activities would lead to.

And you get residual chemicals in the ground from those activities.

What we do in my section, on a daily basis, working with our partners from the other agencies, is investigating the locations of these old activities. Sometimes the buildings are no longer there. We find out, through construction and through investigation, that there are chemicals and fuels in places, and then we set about defining how big that area is, and how to address it.

We do that with what we have here, the proposed plan. And that's on these -- the back tables. I encourage you to grab one, if you haven't already seen one.

The proposed plan is where, after a great deal

of study and evaluation, we in the agencies put out this document, saying this is the best way to clean this site up. We evaluate other alternatives that are in this document.

The preferred alternative is identified and we'll discuss that here this evening.

There is a comment card in the back of this. I encourage you to fill it out. Whether you have opinions about the remedy or the format or -- or anything about the way we're getting this information out, we want to learn.

And we have adjusted this format several times. This is our third public meeting we've had on proposed plans, since last summer.

We had two others that we did for sites that are on the airfield at Andrews. And this is the first one that has been for a site outside of the base proper.

After our proposed plan, we have a 30-day public comment period. It began just this past week, I think last Friday, and that will continue. Comments

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will get sent in to our public affairs office, and then we'll evaluate them, and then respond to them with a document called a Record of Decision, where we and the EPA jointly sign a document saying this is how we're going to proceed.

And we'll discuss in this briefing the human health risk assessment, the two elements of cleanup planned for the Brandywine parcel. And we're going to try to anticipate some of the questions the public might be asking, and we'll move on from there.

Next slide. So the site -- the Brandywine DRMO, Defense Realization Marketing Office, is located right across the street. It's an about 8-acre parcel, began operations in the '40s from the Navy. It was a storage yard. It's handled excess government property. It was a way station for scrap materials and chemicals, and if there are more people here, I'd be curious to know if anyone around here used to work at that facility, but it's been here for many years.

As I mentioned, they handled all sorts of stuff. They had auctions to get rid of excess

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government property, but they also received a lot of waste materials from White Oak Navy Yard, Indianhead Ordnance Depot, there's a number of facilities in the area, that all came through Brandywine. Then they containerized and shipped it off for ultimate disposal.

The activities at the site did release solvents into the environment. Part of that I think was related to the cleaning of the scrap metal before they hauled that away, and what we have is the solvents and polychlorinated biphenyls that have gotten into the environment.

There was a fire at the main warehouse in 1987. That was burned down at that time, and then activities at the site shut down not too long after that. Right now the parcel is primarily vacant and we have a system in place, treating water right now.

The initial cleanup actions that occurred at that time had to do with polychlorinated biphenyls. That is a fluid used in electrical transformers.

They're no longer used today, but they were very common in electrical equipment back at that time.

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There were releases to soil in the environment that were identified in the late '80s; so in the early, '90s, there was a large amount of soil removal that occurred over most of that facility. They took out about 18 inches of soil across most of the site.

Back at that time, a lot of that area had just had aircraft matting. And I think some oils had been sprayed on the ground to keep the dust down during site activities. That's how lot of it got into the soils.

They also stored a lot of transformers there, too, and I think some of it got into the environment that way.

That initial action was taken on the DRMO parcel itself, and around the boundary of the fence, probably about 5 to 10 feet outside the fence in the initial removal action. And about 16,000 yards were removed. Shortly after that time, the remaining buildings were removed and some above-ground tanks were hauled away.

The current systems we have at the site are the groundwater treatment system that was installed in 1996

as a -- just an initial action. We had to do something to begin to pull in this plume that we had identified. It's been running for several years now and they's pulled -- it's basically about a 100-foot long trench on the northeastern side of our property, pulling water out of the ground and treating it, and discharging clean water.

It has removed about 500 pounds of solvents, primarily trichloroethylene, from the water, and it's helping to prevent that spread of this plume.

In the future system, we're going to propose is larger, but similar to what we have on site right now.

And just to give you a sense, this figure I have off to my left shows an area of the community here, and this green, yellow, and orange plume that we'll show zoomed in later, is the extent of the groundwater plume that we've identified in our remedial investigation. So we'll zoom that in, in a moment.

This is our existing treatment system. It's doing a great job, but -- but for a remedy, we're going to need something more than what we have currently.

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But this was the thing that we could install fastest to begin our work while we conducted our remedial investigations.

So let me pull up the zoomed in version here. So what we have here, this is the DRMO parcel. We're located across the street, right around here. You have Bank Street here and Cherry Tree Crossing Road, and then this large green outline is the groundwater plume, and then the yellow and orange are higher concentration areas of that plume. And then, of course, you have the railroad right-of-way coming through here.

During our remedial investigation, for those of you who live around here, we did a lot of borings. We were in the community. We got good cooperation from the health department and from residents, taking samples in people's yards and the railroad right-of-way and surrounding areas, getting samples of the soil and groundwater.

At that time, what we were trying to do is figure out three dimensions: where these chemicals were, what their concentrations were, and then

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evaluating risk.

The way we evaluate risk, this is all -- goes through EPA, is reviewed, and they're tough customers. We've learned to work with them. It's been challenging, but they hold our feet to the fire and keep us honest when we're doing this work.

We want to do good work because we like to get it done right the first time and manage the Air Force's resources wisely.

The risk assessment evaluates different pathways for people to be exposed to these chemicals, whether it's in water, soil, the air, and the different receptors that are identified up here are residents either drinking the water, or coming into contact with it by pumping groundwater and using it in the home, construction workers digging on the site, and even people who are passing through it, like trespassers, that type of activity.

We evaluate future receptors as well, if they were to build some activity over that property in the future, whether it was commercial or residential. And

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the synopsis of it is that, at this time, no one is at risk from this site.

Residents living even though over the edges of the plume -- and it's hard to tell, but the plume does extend out to some homes here. This is in the ground, and the green is low concentrations. Anything in the green is just above the level that's okay to drink, and this is in groundwater.

We've done an extensive well survey of the area around the site and the -- there are no wells within the area of this plume, and the closest well is almost a quarter of a mile to the east of this site.

So the short version of the risk assessment is that nobody is currently at risk from this plume.

The concern is in the future, if a home was to be built on top of this highest concentration area of the plume, obviously if someone were building a house there, the assumption is if they were using the groundwater for drinking and for potable purposes, there would be an issue.

That's the primary driver for our proposed

plan, is to take action to reduce concentrations, certainly in the green area, but in the higher concentration parts of the plume, as well.

Another pathway to consider is volatilization. This is when a chemical leaves the dissolved phase in groundwater and makes its way into the soil gas, and could get up into a structure.

It's more of a concern with radon, like in basements. The homes in this area, very few of them have basements because of the high groundwater.

We have identified one basement that's near the edge of the plume, and we're working with the homeowners who live over the plume, to collect samples from their house.

The risk assessment we've done so far indicates that there's not issue, but EPA thought it would be wise to take samples from the homes to be certain and that's what we're planning on doing in just a couple of weeks.

The PCBs, the polychlorinated biphenyls -- we'll show that in a moment -- that is in sediments,

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not in groundwater. What essentially happened is that they washed off of our site over the years, and made their way down into this wooded drainage here. We'll show that figure in a moment.

The issue there, because of the soil removals that occurred on our property, they're relatively low concentrations that have washed off of our site. And there, there's no risks to humans in that scenario, but in fact the cleanup has to do with protecting the environmental resources out there.

And in this case it was actually earthworms, bird eating the earthworms, and kind of working its way up the food chain that way. And we'll show you that area in a moment.

The soil cleanup for the PCBs, we have what's called an Engineering Evaluation Cost Analysis. There are fact sheets on this back table about the EECA, we call it, as well as the -- for the groundwater cleanup that's in the proposed plan that's, kind of a short version of it. The proposed plan is about 20 odd pages, and the EECA --

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Mark, I'm not sure how thick the EECA is.

SPEAKER: The EECA itself?

MR. DOLAN: Yeah.

SPEAKER: It's probably an inch thick.

MR. DOLAN: It's kind of a hefty document, so the fact sheets give you a short version synopsis of it.

The recommendation in the EECA is to excavate soil within the DRMO, at a couple areas that weren't quite completely cleaned up in the previous removals, very small portion of the site. And then primarily, most of the activity is occurring off-site as you move off of our property and into this wooded area.

And we're working on getting the paperwork finalized to issue a contract to do that work, going into the fall and winter of this year.

So here we have our property, and the area in question moves up from our property, crosses under Cherry Tree Crossing Road, and you see this outline here? This is an area that's above one part per million of PCBs.

We took probably about 150 samples in the sediment, working through the woods here, trying to define this outline here. And it shows up better on the computer screen. We can show you individually what it looks like.

There is also a small section near the front gate and over near the eastern edge of the DRMO, but primarily it starts along the train tracks and works its way up here and here.

In the wooded areas, it does cross past one property here that's a residence in a wooded part of that property, but low concentrations. And, again, for people walking through that area, even for kids playing in that area, not enough to be a risk, but we are doing the removal because of the ecological concerns.

On to the next slide, Mike.

So here's essentially what we're going to do, we're trying to balance the protectiveness for the environment with destroying habitat. Working with fish and wildlife and the EPA and the ecological folks at EPA, the plan is to preserve large trees, and stay I

think 10 feet away from the larger diameter trees out there approximately -- 10-foot radius, I should say, around those trees, to the extent we can, and remove the sediment along the pathways where the PCBs have been identified.

So the goal is to remove as much as we can, while preserving enough of the trees to keep it being sort of a wetland out there. And as part of that, there will be planting of saplings and regrading and vegetation in that area, to let it sprout up the way it was, but it will look a little bit different.

SPEAKER: I have a question.

As far as that PCB removal, what of that green area, what area do you expect there would be soil removal? It's not 100 percent of that area, it's something less than that?

MR. DOLAN: Well, as the sampling goes on, what we're going to do is we're going to begin in areas that are closest to our site, where the highest concentrations are.

As it washes downstream, the concentrations

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decrease. And this is a slow process.
But we would be beginning initially up along the train tracks and on the eastern edge of this wooded parcel here, and as we move down the central drainage channel, that's where the higher concentrations are.

We would be removing it, and working our way outward towards the edge and sampling along the way, until we got to a point where we had removed the bulk of the material.

SPEAKER: Okay.

MR. DOLAN: We'll move onto the groundwater here and we can answer questions on the other stuff as we get towards the end.

The groundwater cleanup, this again is just another depiction of the plume we have up on the board here, the multi colors. And then we have this area in red that is the -- appears to be the source area of this plume. We'll get into that in a moment.

We evaluated a number of different alternatives to clean this up. You can try and remove this mechanically. You can inject a variety of compounds in

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the ground to try and break it down.

The recommended alternative is a combination of the two. What we have on the left side of this figure here, and what's also shown on this figure to my right, is a pattern of injections. And we're also doing groundwater extraction.

The thrust of this cleanup is the fact we're going to use naturally occurring microbes to break down the chemicals in the groundwater. In combination, in the higher concentration areas, we're going to use a mechanical system to pull water out of the ground and clean it up.

So in the outer areas, the more dilute part of the plume where the concentrations are lower, it's essentially vegetable oil that we're putting in ground, mixed with water. And that's going to act as a food source that we'll show you in a moment.

This is a technology that's been used more and more in the last few years because it's very effective. It's not quite as disruptive to the area you're trying to treat as trenching and digging up with pumping

systems.

So on the left here, you see a pattern of yellow dots that represents injection points where the material will be delivered to the ground. And then there are a number of barriers where we're injecting more tightly spaced treatment zones of this same material.

And when we install the pumping system in the central part of the plume, these little dashed lines show how it's going to draw the water back. When it starts pumping, it's going to pull the impacted water back to where the pumps are, and we're going to clean it up in the highest areas that way.

Over a relatively short period of time, we're going to break down the outer parts of the plume, using the vegetable oil fed microbes.

Next slide.

This is a combination figure that's also off to my right we can cover, if people want to come up and look at it more closely later. So the fluid we put in the ground, it's a combination of vegetable oil and

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microbes that we'll be injecting. It's about 95 percent water, a little bit of vegetable oil, and we actually have a sample of it on that back table.

This is food grade vegetable oil, so it's not something that would be an issue if it were on the ground. And the activity of these microbes breaks down the chemicals in the environment.

The new system will help keep the flow of groundwater back towards the source, so it will help keep the plume from spreading. And it will also be reducing concentrations at the same time. We're working on getting a contract finalized.

When the comment period ends, we issue our Record of Decision, which is where we and EPA document the final remedy. The contract will be started to get the ball rolling on the ultimate design and construction of this system, and it should be fall -- going into the fall of this year.

So here is the depiction that's also on the posters. What you have are a small diameter bore hole, probably about 2 inches in diameter, going down into the ground, delivering this mixture of vegetable oil and water into the groundwater. And as that material spreads in the water, it will help feed the microbes that are already there. And their growth, because of this vegetable oil, will help eat up essentially the groundwater contamination.

This bottom part just shows what it looks like when you're injecting this. And we do have, again, samples in the back.

As time goes by, this graphic is just meant to show that microbes are -- are working in this area. You can see images of just small, little points stuck in the ground, kind of evenly spaced out, just small holes when we're done. We would just fill the holes up. Obviously our contractors would have to repair any ruts or anything like that -- that were done in the process.

Any utilities, we're not going to go drilling through everything. If there's utilities, any structures, we'll space our points around and reduce the footprint as much as possible.

This shows the next step where the outer part of the plume is reduced by this continued activity and -- and again, as we move forward, the process is to continue sampling the groundwater to observe our progress.

With these decisions with EPA, we can't just do something and walk away. We have to keep watching it and demonstrating that process is working. In this case, we'll continue to sample these monitoring wells that are located around the community, to see how this plume does change over time.

And so there will be a relatively short frequency sampling in the beginning, and you'll see teams of people out, collecting groundwater samples. And we'll continue that for several years, and then determine whether the remedy is working as planned, or if any changes need to be made.

Some new wells may need to be installed in some of these properties nearest the plume.

This is just a depiction of what -- what it looks like when there's a sample crew on site, working

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around one of these wells. That will be a common sight down here.

So some of the issues that we thought would be probably the most likely questions in this, you know, concerns about safety of the residents, no wells are extracting water for potable use within the plume. That's something we have to emphasize.

The well survey we did, did identify wells beyond the plume and that's not an issue now, but that's why there's some urgency to us getting started with our larger scale cleanup.

The other homes who are connected to public water, get it from WSSC, and obviously they're watching the quality of that water.

Homes with wells farther away from the plume, we're working with the health department to ensure that everyone is aware of exactly where the plume is, and that we monitor its position, and that it's shrinking over time.

For what impacts people will have on their own parcels, that it will certainly be -- for the homes

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right over the plume, there will be some activity with our trucks coming on site, injecting this material into the ground. It will not be a huge burden. It will be over a short duration, these injections. We'll repair any ruts or anything that we make in some of these softer areas of the grass.

Probably the larger things people will notice after the injection is the PCB removal, and that's again going to be near where the Gott Petroleum facility is on Cherry Tree Crossing Road. There is going to be some tree clearing associated with that, as well as some temporary truck traffic, use of backhoes, bulldozers in that area. So that will probably be the most visible evidence of activity over there.

SPEAKER: Brian, quick question.

You're working closely with those property owners that would be the most affected by this?

MR. DOLAN: Absolutely. We've already secured access agreements to all the key properties that we need access to for the cleanup. We are probably going to talk to a couple of additional property owners once

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the design gets finalized.

Right now, we've done plenty of thinking about how it needs to happen, but when the contract is in place, engineers will sit down and specifically figure it out. The pattern might change a little bit from how we have it laid out right now, and that might mean we need to go to another property adjacent to one that we already have access to.

But the goal is to get all the injections, get the system built within the next year, and then operate it and observe its progress over the next several years.

The plume will shrink, and then we'll determine long term, in the highest concentration areas, how long will we be having to be a steward of that area.

The material we're putting in the ground is harmless. Again, it's food grade vegetable oil diluted with water. The microbes in the ground are naturally occurring microbes. We're just creating the right conditions for them to thrive.

For how many times the injection process will

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happen, we're thinking one in the green areas of the plume. The closer you are to the yellow and orange, the higher concentrations that we might need to come back and do injections at some later date, maybe a year later. That will kind of be determined by how quickly the area responds, but that area is mostly just wooded.

Yes, there will be some noise during this activity. The truck that we showed you doing the injections is just like a regular pickup truck. There is a generator that runs while it's working and we'd only be working during the day.

This isn't going to be an around the clock operation as far as the drilling goes.

The PCB removal will probably be the -- there will be some heavy equipment operating, but again, I don't believe they would be working on the weekends. I suppose that's a possibility.

Once you have that equipment in the field, it does cost money, and they may want to work seven days a week to be most effective, but we'll -- they will be providing some information to the community to make

people aware of when they're going to be working.

And we'll also have to work with them, and perhaps public works, as far as putting some signage up for when we do have heavy traffic on Cherry Tree Crossing for a period of time.

I know there are already dump trucks on that road, but certainly for probably about two months when removal is going on for PCBs, there will be some periods when there will be more trucks on the road.

I mentioned before the microbes are naturally occurring. It's only in the last few years that they became aware that these things are in the ground and that they do -- they are able to break down these chemicals.

And really, I think that's partly to explain why this plume has not gotten -- considering how old this plume is, it should -- you would have thought it would have gotten farther away, but the fact that it is where it is right now, demonstrates that some of these microbes have in fact been working on this plume around the fringes. And what we're here to do is to try and

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continue to make it smaller and manage it in the long term.

So that's the main bulk of my presentation. We do have a recorder here. We're going to have minutes of this meeting. If there's any questions, I invite you to ask questions.

If you're comfortable, please identify yourself so we can respond to you.

SPEAKER: My name is Earl Hanzel (sp) and I'm the president of Grand North. And my question is, when you are treating for this PCB, any of those trucks that's coming in and out, are they going to be contaminated some way, and would be going through the community, with chemicals and stuff that probably could be damaging or cause some problems or something happens where they get spilled?

MR. DOLAN: That's a good question.

When the trucks are -- the way the work is going to be set up is the contractors are well aware they don't want to allow contamination to get outside of the site. The good news is the concentrations are

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low, but when they load them into these trucks, the trucks will be sealed.

They're going to have a plastic liner inside the truck and there is a decon station where they're going to be washing the tires of the truck. They will be moving over a gravel construction entrance. They're going to spray off the tires of the truck, wash it down so it's not going down the road, kicking up mud and that sort of thing.

Because it is a wet area and kind of muddy, there is certainly going to be -- I think some mud is probably going to get out around that entrance, and part of the way we design the work is going to have to, you know, minimize or pick the best place for the trucks to be getting back onto the roads.

So part of it might by either on -- perhaps along Bank Street somewhere or maybe even coming into Gott Petroleum, coming out through that parking area there. But that's definitely going to be an area of our attention is to minimize anything coming off of those trucks. And if guys have to sweep or shovel

after the trucks first get on the road, then they'll do that.

MR. FRANZ: Brian, that liquid that would be used to spray off the wheels of the trucks, that will be collected?

MR. DOLAN: Right. There would be a decon station where the trucks will pull into it and there would be a person hosing it down and that water will be collected and dealt with.

SPEAKER: Those trucks will have to be certified, just like any other DOT vehicle that's hauling material, waste materials. They'll have to meet all the same criteria that any vehicle driving on the beltway or anywhere else hauling materials have to meet?

MR. DOLAN: That's right.

There's going to be manifests. There will be paperwork that goes along with these. They'll be sealed up and sent off to a disposable facility.

And as far as the groundwater goes, I don't know if there would be any questions about that, but

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the same type activities goes with groundwater. The extracted water from the treatment system is going to be in a building that will look very similar to one we currently have on our DRMO parcel.

There will be tanks in there to handle the water. We'll probably blow air through it and pull off the chemicals from the water and treat the -- treat the airstream from that system.

The design for that has not -- not yet been initiated, but it will be similar to what we currently are operating here, and the system we have right now is pretty effective.

Again, our proposed plan is in the back with fact sheets. Please take a look at that. There's another three-and-a-half weeks to comment on the proposed plan, and we're going to hang around after this briefing to answer anyone's questions.

But thank you for coming out here, and our information, it's the Wing Public Affairs Office. It's on that board in the back. I'll leave some of my business cards on the table, too, and please -- we

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do -- we do want to get more community participation for these meetings, so at some point in the future we're going to set up a restoration advisory board, where members of the community can sit down with our partnering team and be kept in the loop as to progress on the site.

We did send out a newsletter last fall to the community right around here, and we'll be sending out another one as we get closer to the fall here, and our contracts get in place for the cleanup.

Yes, ma'am?

SPEAKER: I have a question. My name is Brenda. I'm with the Brandywine Volunteer Fire Department.

I was just wondering what the DRMO property and the surrounding areas, what they're going to be used for, once the restoration and cleanup has been done?

MR. DOLAN: The DRMO parcel, Andrews Air Force Base does not have an interest in the DRMO parcel beyond what our responsibility entails to clean it up. We have initiated action at the air force base to

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identify if there are other agencies interested in using that property. It's a very kind of lengthy process, as far as the federal government figuring out who else might have a need for this parcel.

Our goal to get this cleanup going. It will be ready for commercial use before too long, but if there are interested parties that are nongovernmental interested, then I just say talk to your local -- local leadership and work it that way.

It's kind of a lengthy process to go through turning over government land, and it's only just beginning, but certainly I think the base would be open to inquiries from the community.

MR. FRANZ: If I can add to that, while it's a lengthy process, if there is an interest in the community for a functional purpose and that is communicated through the proper channels, through your -- you know, your local community representatives, that can help expedite it, to a certain extent.

MR. DOLAN: Thank you. Okay.

So that's the end the formal briefing. Again,

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my staff is going to hang around here, so you're welcome to grab some refreshments and take a look at the posters and -- and, you know, get us one on one, and ask us any questions you may have.

Thank you very much.

(WHEREUPON THE HEARING WAS concluded AT 6:57 P.M.)

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CERTIFICATE OF SHORTHAND REPORTER NOTARY PUBLIC

I, CHRISTINE FOX, Certified Court Reporter, the officer before whom the foregoing HEARING was taken, do hereby certify that the foregoing transcript is a true and correct record of the testimony given; that said testimony was taken by my stenographically and thereafter reduced to typewriting under my supervision; and that I am neither counsel for, related to, nor employed by any of the parties to this case and have not interest, financial or otherwise, in its outcome.

CHRISTINE FOX
Notary Public in and for the
State of Maryland

My commission expires:
March 16, 2008